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Multi - Sweep
159-C
Maintenance

KAY ELECTRIC CO.

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MAINTENANCE MANUAL
ISSUE C

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MULTI-SWEEP 159-C

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TABLE OF CONTENTS

PARAGRAPH		PAGE
	SECTION I, PRELIMINARY INFORMATION	
1.1	INTRODUCTION	1
1.2	CIRCUIT DESCRIPTION	1
	BLOCK DIAGRAM	2
	SECTION II, ALIGNMENT PROCEDURE	
2.1	INTRODUCTION	3
2.2	FUNCTION OF INTERNAL CONTROLS	3
2.3	ALIGNMENT PROCEDURE	4
	SECTION III, MAINTENANCE	
3.1	INTRODUCTION	14
3.2	VISUAL INSPECTION	14
3.3	PARTS REPLACEMENT	14
3.4	TROUBLESHOOTING DATA	14
3.5	RESHIPMENT INSTRUCTIONS	17
3.6	PARTS LIST	17

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SECTION I

PRELIMINARY INFORMATION

1.1 INTRODUCTION

This manual presents information necessary for the maintenance and calibration of the Multi-Sweep 159-C. A circuit description is included to simplify troubleshooting and repair of the instrument. Use of the description together with the schematics and block diagram is suggested when trying to locate less apparent troubles.

Specifications and operating procedures are found in the 159-C Operator's Manual.

The accessory marker plug-in heads PM-7650 and PM-7660 are described in a separate manual.

1.2 CIRCUIT DESCRIPTION

Sweep Voltage Generator Board No. 9687

The sweep generator circuit develops a sawtooth signal which may be locked at the line frequency or, by changing various circuit constants and removing the line frequency sync signal, may be varied as determined by the front panel SWEEP RATE control. As external signal generator may also be used to supply the sweep generator.

A pulse, taken from the emitter or collector of Q-2 (depends on sweep direction) actuates switching transistor Q-10 which in turn drives Q-11 whose output is used as the RF blanking signal. This signal is applied to the RF oscillator transistors and turns them off during the sawtooth signal retrace time.

Sweep Amplifier and Linearity Board 9688

The sweep sawtooth is passed through the sweep linearity networks (collector circuits, Q-1 and Q-2) which shape the signal to compensate for the non-linearities in the RF oscillator's voltage/frequency curves. This shaped sawtooth signal is impressed across the voltage-variable capacitors in the tank circuits of the RF oscillators, changing the output frequency with respect to time. These shaped signals are also inverted from each other causing one oscillator to sweep up in frequency while the other is sweeping down, each sweeping a total of 150 MHz. The maximum difference frequency therefore equals 300 MHz. This technique is used to minimize output-vs-sweep voltage non-linearities.

The output of the two RF oscillators is mixed by diode D-2 and only the difference frequency is accepted by the filter. Since the frequency range of the high frequency oscillator is 800 to 950 MHz, and the frequency range of the low frequency oscillator is 650 to 800 MHz, the output of the mixer will range between 0 and 300 MHz (both oscillators start at 800 MHz and sweep in opposite direction).

The swept RF output is then passed through a high frequency, wideband amplifier. Samples of this signal passing through this amplifier are taken for the ALC and marker circuits. The amplified output is then passed through the attenuator to the RF OUT jack.

ALC Board No. 9689

The portion of the swept RF signal sampled by diodes D-3 and D-8 generates an error voltage which is amplified by ALC amplifier Q-3, Q-4 and Q-5. This signal is used to control a voltage-variable attenuator (D-1) through which the output of the high frequency oscillator must pass before it is fed into the mixer.

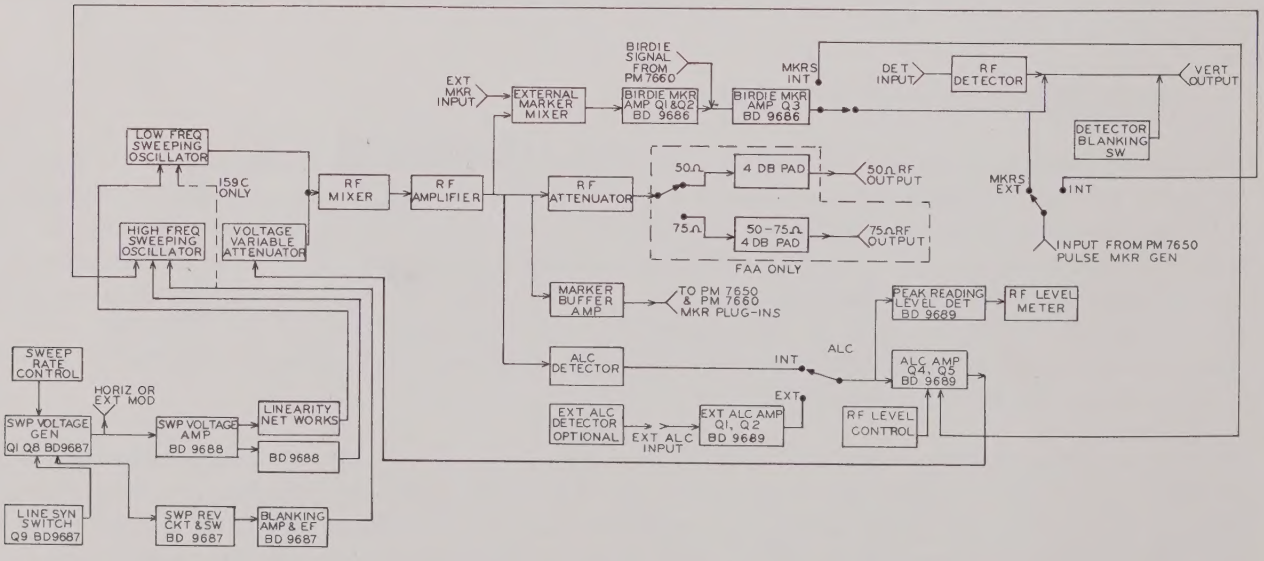
Birdie Marker Output Amplifier Board No. 9686

Birdie markers may be developed in the 159-C by feeding a CW signal (within the range of the instrument) into the MARKER INPUT jack. This CW signal, and a portion of the swept RF signal, is fed into diodes D-6 and D-7 where they are mixed. When the two input signals approach the same frequency an audio beat note is produced. This beat signal is amplified by the birdie marker amplifier and made available at the VERT jack and at the INT marker circuits.

A third portion of the swept RF is fed to buffer amplifier Q-8 and then to the plug-in head marker circuits. The buffer amplifier serves to isolate the RF circuits from the marker circuits.

General

In order to obtain the detected envelope of a response curve the output of the device under test may be patched into the DETECTOR jack (provided the output impedance of the device matches the input of the DETECTOR: 50 or 75 ohms). The RF signal is detected by the voltage doubler diode detector circuit (D-4 and D-5) and the response envelope is made available at the VERT jack.



NOTE:
MAIN SIGNALS ENTER ON LEFT, LEAVE ON RIGHT.
AUXILARY OR CONTROL SIGNALS ENTER & LEAVE ON TOP & BOTTOM.

FIG. 1.1, FUNCTIONAL BLOCK DIAGRAM

SECTION II

ALIGNMENT PROCEDURE

2.1 INTRODUCTION

This section will provide the operator with information necessary to perform a complete factory type alignment of the instrument. The troubleshooting section may be used should any difficulties be experienced in meeting the specifications called for. The accuracy of these alignments will be maintained by allowing for a reasonable warm-up period.

When performing alignments which require removal of the oscillator or amplifier covers, the accuracy of linearity, harmonic distortion etc., will be affected. It is suggested that a complete re-alignment of the instrument be completed after such adjustments.

2.2 FUNCTION OF INTERNAL CONTROLS

CONTROL	COMPONENT	FUNCTION
P/C/B ~~9658~~ 9685		
+62 Volt Adj.	R-13	
+30 Volt Adj.	R-23	Adjustment of power supply voltages.
-30 Volt Adj.	R-36	
P/C/B 9687		
Zero Symmetry Adj.	R-14	Adjusts sweep waveform for symmetry about zero volts.
Sweep Ratio Adj.	R-20	Adjusts triangular waveform rise/fall time ratio.
P/C/B 9688		
Sweep Width "L"	R-1	Adjusts for full 1-300 MHz sweep.
Sweep Balance "A"	R-26	Calibration of Center Frequency dial.
High Frequency Adj. "J"	R-30	Calibration of Center Frequency dial.
Center Frequency Adj. "K"	R-21	Calibration of Center Frequency dial.
Sweep Linearity "B" thru "I"		Adjusts swept frequency calibration.
P/C/B 9689		
EXT ALC Offset	R-6	Compensates for variations in EXT ALC detectors. Sets ALC within its operating range.
Meter Adj.	R-16	Adjusts meter to read 0.5 V rms with 0.5 V at RF OUT jack.
MAIN CHASSIS		
Mixer Bias Adj.	R-35	Adjust for proper bias on the RF mixer.
Sweep Ratio Adj.	R-103	Adjust for proper sweep ration.
Line Lock Adj.	R-105	Adjust for synchronization of sweep voltage with line frequency.

2.3 ALIGNMENT PROCEDURE

Equipment Required:

Oscilloscope, Tektronix 503 or equiv.
Oscilloscope, Tektronix 561 with type 2A63 and 2B67 plug-in heads.

VTVM
Power Meter
RF Generator - 1-300 MHz
Audio Oscillator - Donner Model 1202 or equiv.
UHF Grid Dip Meter
Variable Autotransformer
Attenuator - 0.5 db steps

A. POWER SUPPLY - BOARD NO. 9685

NOTE: The +62 volt supply feeds the regulation circuits and should be adjusted first.

1. Using a VTVM on pin H or PJ-9, adjust R-13 for +62 volts.

2. Adjust R-23 for +30 volts on pin R of PJ-9.

3. Adjust R-36 for -30 volts on pin C of PJ-9.

4. Using an autotransformer, vary the line voltage between 105 and 128 volts. The +62 volt supply should vary no more than 12 mv, the +30 volt supply should vary no more than 15 mv, and the -30 volt supply should vary no more than 95 mv.

5. To check the AC ripple content of the power supplies, set up the 159-C as follows:

   a. FUNCTION SELECTOR - CW
   b. CENTER FREQUENCY - 150 MHz
   c. MARKER LEVEL & GAIN - Fully CCW
   d. Remove any marker plug-in head

   Use a non-attenuating shielded scope probe and check for the following:
   a. Pin "H" Board No. 9685 _ 0.5 mv p/p
   b. Pin "R" Board No. 9685 _ 1.2 mv p/p
   c. Pin "C" Board No. 9685 _ 0.5 mv p/p

B. SWEEP VOLTAGE GENERATOR

1. Interconnect the 159-C with an oscilloscope to display the sweep sawtooth (159-C HORIZ jack to VERTICAL input of the scope).

2. Place the 159-C controls in the following position:

   a. FUNCTION SELECTOR - VAR
   b. SWEEP RATE - 100 Hz

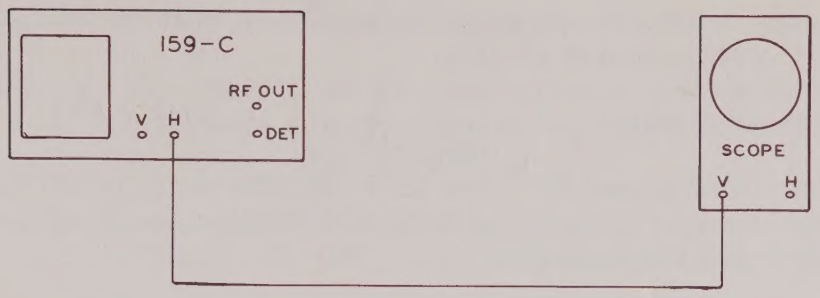


FIG. 2.1

3. Place the internal controls in the following position:

   a. ZERO SYMMETRY ADJ - Midrange
   b. SWEEP RATIO ADJ - (R-24) Midrange

4. Adjust SWEEP RATIO ADJ (rear panel to midrange).

5. Center sweep on horizontal axis of scope.

6. Adjust ZERO SYMMETRY ADJ for a symmetrical waveform. Peak to peak voltage should be 9 V approximately.

7. Set the SWEEP RATIO ADJ (rear panel) to maximum clockwise, and the scope time base for 1 ms/cm.

8. Adjust the SWEEP RATIO ADJ (R-24, Board #9687) for a rise time of 0.4 ms and a fall time of 5 ms. Adjust SWEEP RATE to obtain proper timing.

9. Adjust SWEEP RATIO ADJ (R-103, Main Chassis) counterclockwise for the inverse ratio of Step 8. Reset for symmetrical sweep.

10. Check sweep rate positions. There are no adjustments for these ranges, since they are determined by fixed circuits.

11. Place the front panel controls in the LINE LOCK position.

12. Using the LINE LOCK ADJ (R-105, Main Chassis), lock the sweep to the line frequency.

C. SWEEPING OSCILLATOR ALIGNMENT

1. Turn all controls on the SWEEP AMPLIFIER and LINEARITY BOARD to midrange.

2. Set the front panel FUNCTION SELECTOR to CW.

3. Connect the VTVM across C-10 of the 800 to 950 MHz oscillator and tune the CENTER FREQUENCY dial for 45 volts. The ZERO ADJUST (front panel) may have to be slightly adjusted to obtain this reading.

4. Remove the ALC board. BD 9689

5

Feed thru cap in between BD'S 9689 & 9688, also use chassis GROUND.

5. Probe the 800 to 950 MHz oscillator with the grid dip meter and adjust the lead length of C-8 for a peak reading at 950 MHz.

6. Reinstall the ALC board.

7. Connect the VTVM across C-3 of the 650 to 800 MHz oscillator and tune the CENTER FREQUENCY dial for 45 volts. The ZERO ADJUST (front panel) may have to be slightly adjusted to obtain this reading.

8. Probe the oscillator with the grid dip meter and adjust the lead length of C-6 for a peak reading of 800 MHz.

D. RF MIXER BIAS

Adjust RF LEVEL (front panel) and RF LEVEL (internal) maximum clockwise.

1. Interconnect equipment as shown in Fig. 2.2.

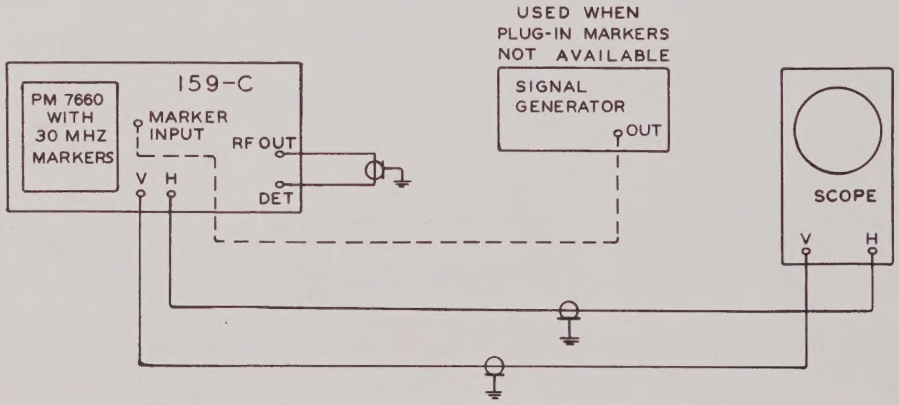


FIG. 2.2

2. Set up the 159-C as follows:

   a. FUNCTION SELECTOR - VAR
   b. SWEEP WIDTH - Maximum
   c. SWEEP WIDTH SWITCH - X1
   d. CENTER FREQUENCY - 150 MHz
   e. MARKER SWITCH (rear panel) - EXT
   f. SWEEP RATE RANGE - 10-100 Hz
   g. SWEEP RATE VARIABLE - Midrange
   h. SWEEP DIRECTION (rear panel) - L to H
   i. ALC - INTERNAL
   j. BLANKING - ON

3. Turn all amplifier trimmer coils and capacitors to midrange.

4. Adjust the MIXER BIAS control (R-35) for maximum output at 300 MHz.

5. Tune the trimmer coils and capacitors for maximum observed output.

6. Adjust the RF LEVEL controls for a 4.2 cm high scope presentation. Check for proper ALC action. Turn all markers off and adjust the MIXER BIAS control for minimum observed spurious at approximately 330 MHz.

7. Switch on 1 MHz markers and adjust the SWEEP WIDTH controls so that the zero beat region may be examined. See that the unit sweeps below 1 MHz in either H to L or L to H sweep direction.

8. If the conditions of Step (7) cannot be obtained, the coupling loop in the 650 to 800 MHz oscillator may be moved away from the oscillator tank circuit approximately 3/32 of an inch. Slight re-adjustment of the MIXER BIAS control may also be tried.

9. Repeat Steps 6 thru 8 for best compromise.

E. RF AMPLIFIER

1. Set up equipment as for the RF MIXER alignment.

2. Set the scope horizontal for external sweep and the vertical to 0.2v/cm.

3. Provide 30 MHz markers and adjust the MARKER LEVEL controls for useable markers.

4. Use the CENTER FREQUENCY dial to enable a full 1-300 MHz sweep.

5. Turn the RF LEVEL control to maximum clockwise. Adjust the internal RF LEVEL control for 4.2 cm of ALC'd detected output.

6. Switch the FUNCTION SELECTOR to MAN and using the MANUAL SWEEP control, set the output to approximately 90 MHz.

7. Attach the Power Meter to the RF OUTPUT connector and set the internal RF LEVEL control for a 5 mw reading.

8. Remove the Power Meter and reconnect the RF OUTPUT to the DETECTOR.

9. Switch the FUNCTION SELECTOR to VAR.

10. Note the ALC'd level and note for future use.

11. Use the METER ADJ for 0.5 V rms on the front panel meter.

12. Tune all amplifier trimmers so as to maximize the high frequency output.

13. Adjust the internal RF LEVEL control so that the RF output is increased and the ALC no longer has any effect. Between 1 MHz and 300 MHz the output should be at least 1 cm over the reference level observed in Step 10.

14. Reset the RF LEVEL (internal) control for 0.5 V.

15. Switch in 6 db of attenuation and note the output level.

16. Switch out the attenuation and turn both RF LEVEL controls down. See that the level is equal to that noted in Step 15.

17. Reset the 0.5 V rms level. Turn the FUNCTION SELECTOR to LINE LOCK and place the rear panel SWEEP DIRECTION switch to the H-L position. See that the sweep is flat for the entire sweep width (1-300 MHz).

18. Throw in 3 db of attenuation and note the level. Switch out the attenuation.

19. Disconnect the cable from J-17 (MARKER BUFFER AMPLIFIER) and provide a connection between J-17 and the RF DETECTOR.

20. Switch in 40 db of attenuation.

21. The output should be equal to or greater than that noted in Step 18. Coil L-9 (MARKER BUFFER AMPLIFIER) may be adjusted to obtain this level.

22. Return the unit to normal operation.

F. HARMONIC AND SPURIOUS DISTORTION

1. For this alignment the use of a good distortion analyzer is suggested.

2. It is generally adequate to check for the following harmonic and spurious: 25, 50, 100, 150, 200, 450, and 600 MHz.

3. The distortion and spurious should be at least 30 db below the fundamental signal level.

4. Vary the RF LEVEL control and check the distortion at 0 db, -1 db, -2 db, and -3 db of output.

5. To adjust for distortion, the following is suggested:

   a. If the unit is out of specification at -2 to -3 db of output the unit has too much gain. For harmonic frequencies below 100 MHz, raise the value of R-33, R-41 or R-54 in the RF AMPLIFIER as high as 68 ohms. Only change one at a time until an acceptable value is reached. To reduce harmonic frequencies of 100 MHz, and above the amplifier trimmers may be adjusted.

   b. If the unit is out of specification at 0 to -1 db outputs, the system has too little gain. For harmonic frequencies below 100 MHz, R-33, R-41 and R-54 may be reduced as low as 33 ohms (one at a time). For harmonic frequency above 100 MHz, adjust the amplifier trimmers.

6. If any adjustments were made to the amplifiers, recheck the RF MIXER BIAS and RF AMPLIFIER alignment.

G. LINEARITY AND DIAL CALIBRATION

NOTE: These adjustments should be made with the RF Oscillator and RF Amplifier covers securely fastened.

1. Set the controls on Board #9688 as follows:

   a. SWEEP WIDTH "L" - Midrange
   b. HIGH FREQ ADJ "J" - Midrange
   c. CENTER FREQ ADJ "K" - Midrange
   d. SWEEP BAL "A" - Midrange
   e. LINEARITY ADJ (F, H, B, D) - Maximum counterclockwise
   f. LINEARITY ADJ (G, I, C, E) - Maximum clockwise

2. Place the FUNCTION SELECTOR in the CW position.

3. Turn the CENTER FREQUENCY dial until zero volts is measured at pin "U" of Board #9688 (Use VTVM on 1.5 volt range).

4. Using the SWEEP BAL "A" control, adjust for a median voltage of 26 volts on C-9 and C-15 (high and low frequency oscillators). For example: C-15 reads 25 volts and C-9 reads 27 volts, median = 26 volts.

5. Remove the horizontal input to the scope and center the dot. Reconnect the horizontal input and disconnect the vertical. Use the ZERO SYMMETRY ADJ (R-14, Board #9687) to center the trace again. Reconnect the vertical input.

6. Provide 30 MHz markers and use the CENTER FREQUENCY dial to exactly center the 150 MHz marker. Adjust the RF OUTPUT for 0.5 V rms.

7. Place the SWEEP WIDTH switch to the X0.1 position. Turn the front panel SWEEP WIDTH control to its minimum range. Slightly adjust the CENTER FREQUENCY dial to put the 150 MHz marker on the center of the scope.

8. Readjust the SWEEP WIDTH control for a full sweep on the X0.1 position. See that the marker falls within ±1/10 cm of the vertical axis. The marker maybe centered by selecting R-25 (500K to ∞) and returning it to either +30 volt or -30 volts.

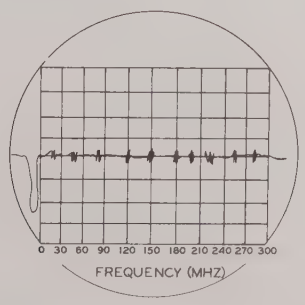


FIG. 2.3 120, 150, 180 MHz MARKERS PROPERLY ALIGNED

9. Adjust the horizontal gain of the scope so that the sweep is approximately $\frac{1}{2}$ cm wider than the scope graticule.

10. Use the CENTER FREQUENCY dial and the SWEEP WIDTH control to position the 120, 150 and 180 MHz markers exactly (within .05 cm) behind the middle three verticals on the scope.

11. The following chart shows the order in which the markers are aligned for proper linearity.

SEQUENCE	MARKER FREQUENCY	CONTROL	
		THRESHOLD	MAGNITUDE
1	210	B	C
2	240	--	C
3	270	D	E
4	300	--	E
5	90	F	G
6	60	--	G
7	30	H	I
8	0	--	I

NOTE: The alignment must be done in the order shown.

12. All markers are adjusted in the same manner, so only one example will be examined.

    a. Use the threshold control "B" to position the 210 MHz marker slightly to the 180 MHz side of the vertical. Now use the magnitude control "C" to bring the marker exactly on its proper vertical. The procedure may have to be repeated to eliminate any interaction of controls. For proper alignment the 240 MHz marker will fall on its proper vertical.

13. Continue the alignment following the chart (all markers to be within $\pm$ 0.05 cm of their verticals).

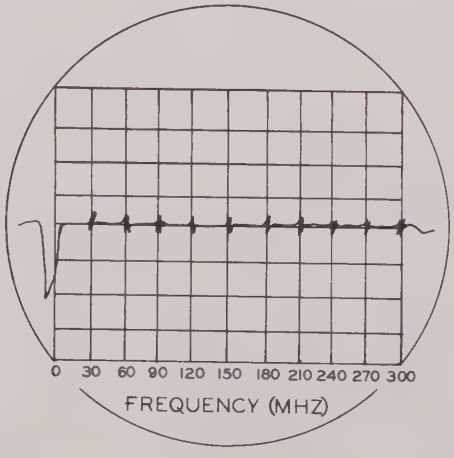


FIG. 2.4, ALL MARKERS PROPERLY ALIGNED

14. Turn the CENTER FREQUENCY dial to zero and the SWEEP WIDTH control near maximum CCW. Use the ZERO ADJ control to center the zero beat.

15. Turn the CENTER FREQUENCY dial to 300 and use the HIGH FREQ ADJ "J" to center the 300 MHz marker.

16. Repeat the above steps until no further adjustment is necessary,

17. Center the 150 MHz marker. The dial should read 150 MHz ±600 KHz. The CENTER FREQ ADJ "K" may be used to center the marker. (Then repeat Steps 14 thru 17)

18. Check that each marker (when centered) is within ± 3 MHz of its specified frequency.

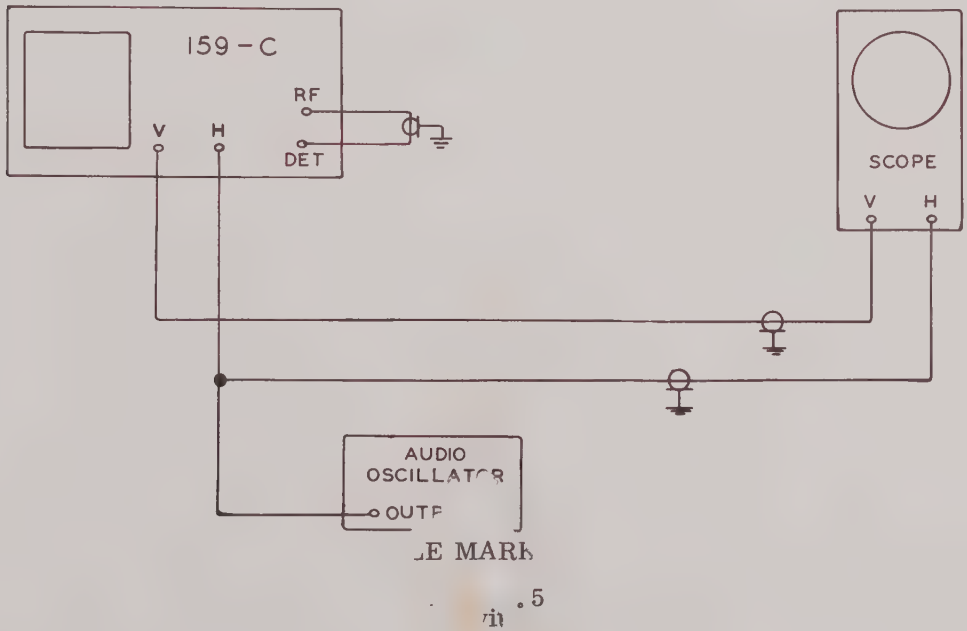
H. SWEEP WIDTH

1. Set the SWEEP WIDTH control to maximum CW and see that the 1-300 MHz sweep comprises about 75% of the total sweep.

2. Adjust SWEEP WIDTH "L" Board #9688 to obtain the proper sweep.

I. EXTERNAL MODULATION

1. Connect equipment as shown in Fig. 2.5.



2. Set 159-C controls as follows:

FUNCTION SELECTOR - EXT
SWEEP WIDTH - Fully CW
SWEEP WIDTH switch - X1
CENTER FREQ dial - 150 MHz

3. Adjust the audio oscillator for 60 Hz at 2.5 p/p output.

4. See that the zero beat and the 300 MHz marker are visable on the oscilloscope.

5. Repeat Steps 3 and 4 for 400 Hz.

J. METER ADJUSTMENT

1. Interconnect equipment as for the RF AMPLIFIER adjustment.

2. Turn the RF LEVEL control fully clockwise and adjust the RF LEVEL (INT) for 0.1 cm greater than the 0.5 V rms reference level established in Step 10 of the RF AMPLIFIER alignment.

3. Turn the RF LEVEL control down until the 0.5 V reference is reached.

4. Reduce the sweep width until the entire sweep is ALC'D.

5. Use the METER ADJ (INT) to adjust for a 0.5 V rms reading on the meter.

6. Switch in 3 db of attenuation and note the level. Remove the attenuation.

7. Turn the RF LEVEL clockwise until the -3 db level is reached. The meter should read -3 db $\pm$ 0.2 db.

8. Set the RF LEVEL for 0.5 V rms and turn the SWEEP RATE RANGE to the 10-100 Hz position with the VARIABLE control fully clockwise. Turn the VARIABLE control fully counterclockwise and see that the meter moves no more then 0.2 db.

9. With the VARIABLE control fully clockwise, turn the BLANKING off. See that the meter rises no more than 0.3 db.

K. FLATNESS CHECK

1. Set the 159-C for 300 MHz sweep, BLANKING on, SWEEP RATE approximately 50 Hz.

2. Interconnect equipment as in Fig. 2.6.

3. Switch in 0.2 db of attenuation and note the level change at 60 MHz.

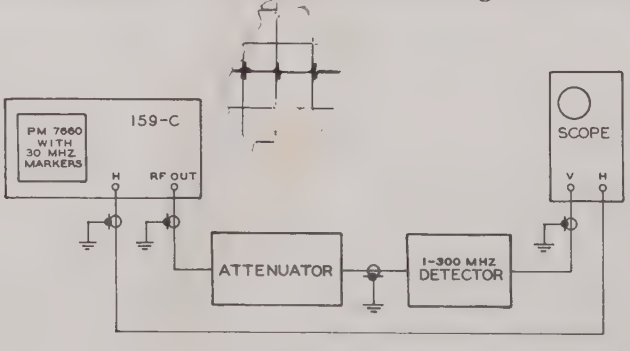


FIG. 2.6

4. Remove the attenuator from the system.

5. Check the entire sweep width and see that the level change does not exceed that of step 3.

L. MANUAL SWEEP

1. Interconnect equipment as for the SWEEP VOLTAGE alignment.

2. Switch to the MANUAL position.

3. See that the MANUAL SWEEP control can vary the trace at least the fully 300 MHz sweep width.

M. RF DETECTOR

1. Interconnect equipment as per the flatness check substituting the 159-C internal detector for the external detector.

2. Establish a reference as in the flatness check and see that the 150-C is flat to within ± 0.25 db.

N. MARKER CIRCUITS

A. VARIABLE MARKER

1. Interconnect the 159-C and the oscilloscope so as to display a detected output.

2. Using an external signal generator feed in a 60 MHz CW isgnal at 1 V rms. Attenuate this signal by 40 db.

3. Adjust the front panel controls for a birdie approximately 2 cm wide and centered on the scope.

4. The amplitude should be greater than 4 cm.

5. Increase the generator output until the marker begins to distort. The birdie should be at least 10 V p/p.

B. INTERNAL BIRDIE MARKERS

1. Proceed as for the VARIABLE MARKER.

2. Place the rear apron MARKER switch to INTERNAL and set the SWEEP WIDTH to 300 MHz.

3. Adjust the signal generator for 1 V rms output.

4. Use the 159-C MARKER GAIN controls to obtain a birdie of at least 0.3 V p/p.

5. Return to normal operation.

SECTION III

MAINTENANCE

3.1 INTRODUCTION

This section contains information which will be useful when servicing the 159-C. To minimize unnecessary labor, try to use the alignment procedure before making any repairs, as certain abnormalities may be compensated for by using the proper adjustment.

3.2 VISUAL INSPECTION

It is suggested that the 159-C be checked periodically, usually during alignment or routine inspections, for such things as loose or broken connections, loose jacks and connectors, or faulty printed circuit boards. Obvious signs of overheating such as burned wires, or signs of arcing may indicate more serious but less apparent troubles.

3.3 PARTS REPLACEMENT

Most of the components used in the 159-C are easily accessible and require no special replacement techniques. Some components, such as the solid state devices, may be damaged by intense heat and special care should be exercised when soldering. Longnose pliers may be used as a heat sink between the component and the soldering iron. To avoid damaging semiconductors with low voltage ratings, see that the tip of the soldering iron is at an electrical ground potential.

The oscillator and amplifier sections are highly critical. To maintain the proper operation of these circuits, it is important that all components be replaced in their original positions and that the lead lengths remain the same.

3.4 TROUBLESHOOTING DATA

The following information is provided as a guide to follow when attempting to locate circuit malfunctions within the 159-C. The schematics and the Alignment Procedure will also be helpful when tracing the location of a specific problem.

POWER SUPPLY DC VOLTAGE LEVELS

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q-1	+62 V	+63 V	+90 V*
Q-2	+47 V	+47.7 V	+63 V
Q-3	+62 V	+62V	+63 V
Q-4	+8.4 V	+9 V	+49 V
Q-5	+8.4 V	+9 V	+54 V
Q-6	+30 V	+30.5 V	+41.5 V*
Q-7	+30 V	+30 V	+30.5 V
Q-8	+6.8 V	+7.4 V	+30.5 V
Q-9	-30 V	-30.5 V	-43 V*
Q-10	-30.5 V	-31 V	-43 V
Q-11	-30 V	-30 V	-31 V
Q-12	0 V	-0.6 V	-31 V
* AC LINE VOLTAGE AT 117 V.			

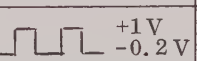
NO SIGNAL AT ANY OUTPUT

Check fuse F-1, the line cord and the power switch for continuity. If these prove satisfactory, check the primary windings of transformer T-1.

If all the previous checks prove acceptable, measure the output of each power supply. The +62 volt supply regulates the +30 V and -30 V supplies and should be check first. Try the alignment procedure to bring the voltages back to normal. The power supply voltage chart may be used to check these circuits. The voltage readings given are approximate and vary according to the AC line voltage and the settings of the power supply potentiometers.

IMPROPER HORIZONTAL OUTPUT

Check the SWEEP VOLTAGE GENERATOR Board #9687. See that the sweep circuits are properly aligned. Refer to the schematic and to the voltage chart for proper waveforms.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	-8.5 V -23 V	-7 V -20 V -26 V	
Q2	Same as Q1 E		0 -8.6 V
Q3	-4.4V (.070 V p/p)	-3.8V (.075 V p/p)	
Q4	-3.8 V (.070 V p/p)	Same as Q3 E	
Q5	-3.2 V (.050 V p/p)	Same as Q4 E	-6.5 V -18.5V
Q6	Same as Q5 E	-3.8 V (.030 V p/p)	-11 V -18 V
Q7	-7 V -19 V	Same as Q5 C	-0.3 V -1.2 V
Q8	+5.5 V -5.5 V		+27.5 V +12 V
Q9	0	+9 V -0.2 V	0 V -30 V
Q10	0	Swp L-H  +1 V -0.2 V Swp H-L 0 -0.2 V	
Q11	Swp L-H 0 -20 V Swp H-L 0 -20 V		

IMPROPER VERTICAL OUTPUT, RF OUTPUT IS NORMAL

Check diodes D-4 and D-5 in the RF detector circuits.

LINE LOCK INOPERATIVE

If all other indications are normal, check the 6.3 volt AC winding of T-1.

If the 6.3 volt AC signal is present at pin "F" of Board #9687, the LINE SYNC switch circuit should be examined. Consult the voltage chart for approximate D.C. levels and proper waveforms.

LOW RF OUTPUT

When the output is low, the RF amplifier and oscillator circuits should be checked first. Consult the Alignment Procedure for proper calibration levels. See that the ALC is functioning properly. Refer the voltage charts for approximate D.C. voltage levels.

RF OSCILLATOR DC VOLTAGE LEVELS

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q-1		+.3 V -3.5 V	-20 V
Q-2		+.3 V -3.5 V	-20 V

RF AMPLIFIER DC VOLTAGE LEVELS

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q-3	+12.5 V	+12.8 V	+26.5 V
Q-4	+12.5 V	+12.8 V	+26.5 V
Q-5	+12.6 V	+13 V	+26.8 V
Q-6	+12.6 V	+13 V	+27 V
Q-7	+14 V	+14.2 V	+27 V
Q-8	+9 V	+9.2 V	+21.5 V
Q-9	+7 V	+7.2 V	+24 V
Q-10	-16 V	------	-------
Q-11	GND	------	-12.7 V
Q-12	+10 V	+10.2 V	+22 V
Q-13	+19 V	+19.2 V	+27 V

NO BASELINE

Check the BLANKING AMPLIFIER circuitry. Switch to the LINE LOCK function and refer to the voltage chart.

INSUFFICIENT SWEEP WIDTH IN:

A. LINE LOCK AND VAR SWEEP

If the unit operates properly in the MAN position, but will not sweep the full range in these

functions, check first for a sawtooth of approximately 10 V peak-to-peak at the HORIZ jack. If this is obtained, try adjusting SWEEP WIDTH pot R-1 on the Sweep Amplifier and Linearity board. Should this fail, the entire Sweep Voltage Generator should be examined.

B. MANUAL SWEEP

Check R-102 (Front Panel Control), R-4 and R-5 (on P/C/B #9688. Check for continuity thru FUNCTION SELECTOR switch (S-1).

SWEEP NOT LINEAR

Check for continuity thru linearity networks. Check to see that linearity adjustment is correct.

IMPROPER RF OUTPUT

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q-1 (1)	-1.3 V		+27 V
Q-2 (1)	+2.2 V -0.24 V	+1.5 V -0.9 V	-27 V
Q-3 (2)	+1.8 V +1.0 V	±2.4 V +1.6 V	+6.8 V +9.4 V
Q-4 (2)	+1.8 V +1.0 V	+2.4 V +1.4 V	+10.1 V +10.0 V
Q-5 (2)	+9.5 V +9.4 V	+10.1 V +10.0 V	+18.5 V +18.0 V

(1) CONDITIONS OF MEASUREMENT

a. No Input Signal to EXT ALC INPUT
b. S-1 on INTERNAL
c. Upper Voltage - R-6 Minimum
d. Lower Voltage - R-6 Maximum

(2) CONDITIONS OF MEASUREMENT

a. ALC - INT
b. CENTER FREQ - Midrange
c. FUNCTION - CW

3.5 RESHIPMENT INSTRUCTIONS

When returning equipment for any reason, it is necessary to secure permission from the factory or an accredited Kay representative before doing so.

When preparing the Multi-Sweep for shipping, please see that the instrument is securely wrapped and padded. A packing slip listing the shippers identification, instrument type and serial number, and a statement indicating the malfunction.

3.6 PARTS LIST

To insure satifactory performance when repairing the 159-C, the use of exact replacement parts is suggested. These are available from the Kay Electric Company. When ordering parts, please make reference to the instrument type, serial number, the component's circuit symbol number and the Kay part number.

PARTS LIST - MAIN CHASSIS, DWG. NO. 9739

CAPACITORS: (All capacitors in μμf, 500 volts, unless otherwise indicated)

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
C1 & C2	1000, ceramic feed thru	6356-9	Allen Bradley FUD-102W
C3	50, ceramic feed thru	6356-8	Erie 2443-000-U2M0-500K
C4 & C5	1000, ceramic feed thru	6356-9	Allen Bradley FUD-102W
C6	39, silver mica	6359-59	Elmenco DM15-390
C7	Vari cap, VA115	8227	Crystalonic VA115
C8	39, silver mica	6359-59	Elmenco DM15-390
C9	Vari cap, VA115	8227	Crystalonic VA115
C10	50, ceramic feed thru	6356-8	Erie 2443-000-U2M0-500K
C11	1000, ceramic feed thru	6356-9	Allen Bradley FUD-102W
C12	1.8, ceramic tubular	6361-59	Quality Component QC 1.8
C13	4.7, ceramic tubular 63	6361-27	Quality Component QC 4.7
C14 & C15	5, Button	6707-8	Erie 652-020
C16	1.2, ceramic tubular	6361-42	Quality Component QC 1.2
C17	4.7, ceramic tubular	6361-27	Quality Component QC 4.7
C18	15, Button	-------	Erie 666-003-14AD-150K
C19	1000, ceramic feed thru	6356-9	Allen Bradley FUD-102W
C20	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C21	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C22	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C23	Not Used		
C24	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C25	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C26	7, silver mica	6359-76	Elmenco DM15-070
C27	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C28	2-18, ceramic trimmer	-------	Amperex cou 4 ea/18E
C29	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C30 & C31	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C32	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C33	24, silver mica	6359-81	Elmenco DM15-240
C34 & C35	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C36	2-18, ceramic trimmer	-------	Amperex cou 4 ea/18E
C37	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C38 & C39	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C40	.0022 μf, 200V	-------	Erie 8131-026-X4R0-222K
C41	15, silver mica	6359-55	Elmenco DM15-200
C42 & C43	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C44	2-18, ceramic trimmer	-------	Amperex cou 4 ea/18E
C45	20, silver mica	6359-57	Elmenco DM15-200
C46	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C47 & C48	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C49	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C50	2-18, ceramic trimmer	-------	Amperex cou 4 ea/18E
C51	24, silver mica	6359-81	Elmenco DM15-240
C52 & C53	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C54	4000, ceramic feed thru	6356-5	Erie 2443-000-Z5U0-402M
C55 & C56	.05 μf, 75V, ceramic disc	6360-16	Gulton MIN-V-.05Z
C57	30 μf, 50V, electrolytic	6355-77	Sprague 40D306F050DD3
C58	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C59	4000, ceramic feed thru	6356-5	Erie 2443-000-Z5U0-402M
C60	500, silver mica	6359-66	Elmenco DM15-101
C61	1000, ceramic feed thru	-------	Erie 2443-000-X5U0
C62 & C63	.0022 μf, 200V	-------	Erie 8131-026-X5R0-222K
C64	7, silver mica	6359-76	Elmenco DM15-070
C65	.02 μf, 75V, ceramic disc	6360-23	Gulton MIN-Z-.02Z
C66	.68 μf, electrolytic	6355-83	Texas SCM 684FP035D2
C67	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C68	500, ceramic disc	6360-12	RMC Type B Z5U
C69	39, silver mica	6359-59	Elmenco DM15-390
C70	8500, ceramic feed thru	6357-7	Erie 0327-000-X5V0
C71 & C72	25 μf, 25V, electrolytic	6355-78	Sprague 40D256F025DD3
C73	22 μf, 35V, electrolytic	6355-135	Texas Type SCM
C74	2 μf, 200V, mylar	6411-22	Electrocube 212A1C 205K
C75	.22 μf, 50V, mylar	6411-1	Goodall 601PE
C76	.02 μf, 100V, mylar-paper	6899-13	Elmenco 1 DP-1-103
C77	.002 μf, 600V, mylar-paper	6899-4	Elmenco 6 DP-1-202
C78 A, B, C,	100/80/300 μf, 150V, elect.	6355-69	Mallory FP312.6
C79	1500 μf, 50V, electrolytic	6355-115	Mallory WP 068
C80	1.1, ceramic tubular	6361-55	Quality Component QC 1.1

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
C81	1.5, ceramic tubular	6361-35	Quality Component QC 1.5
C82	1.1, ceramic tubular	6361-55	Quality Component QC 1.1
C83	20, silver mica	6359-57	Elmenco DM15-200
C84	3.9, ceramic tubular	6361-57	Quality Component QC 3.9
C85	100, silver mica	6359-46	Elmenco DM15-101
DIODES:			
D1	3039, pin diode	6357-108	H.P. Assoc. 3039
D2	D3530, silicon	6357-51	Sylvania D3530
D3	1N82A, silicon	6357-38	Microwave Assoc. 1N82A
D4 & D5	D3530, silicon	6357-51	Sylvania D3530
D6 thru D8	1N82A, silicon	6357-38	Microwave Assoc. 1N82A
F1	Fuse, ½ amp. slow-blow	6908-18	Littelfuse 313.500
I1	Lamp, bayonet, #44	249-44	General Electric #44
CONNECTORS:			
J1	26-183, receptacle	6909-2	Amphenol 26-183
J2	UG625B/U, coax	6909-100	Spec. Connector 28JR121-2
J3	UG290/U, coax	6909-26	Dage UG290/U
J4	UG909/U, coax	6909-96	Dage UG909/U
J5	UG1051/U, coax	6909-28	I.P.C. UG1051/U
J6	UG909/U, coax	6909-96	Dage UG909/U
J7	Not Used		
J8	UG625B/U, coax	6909-100	Spec. Connector 28JR121-2
J9 thru J13	143-018-01, receptacle	6909-99	Amphenol 143-018-01
J14	UG185/U, coax	6909-77	Dage UG185/U
J15	UG535/U, coax	6909-80	Dage UG535/U
J16	UG535/U, coax	6909-80	Dage UG535/U
J17 & J18	UG185/U, coax	6909-77	Dage UG185/U
COILS:			
L1	Special, wound on R3, 5.6K, ¼W	L1-9739A	Kay Electric Co.
L2	Special, wound on R9, 5.6K, ¼W	L2-9739	Kay Electric Co.
L3	Special	9953-2	Kay Electric Co.
L4	Special, wound on R16, 1K, ¼W	L4-9739A	Kay Electric Co.
L5	Special, wound on R18, 1K, ¼W	L5-9739A	Kay Electric Co.
L6	Special	9953-1	Kay Electric Co.
L7	Special, slug-tuned	L7-9739A	Kay Electric Co.
L8	1MH, choke	6394-20	Cadell Burns 659-3
L9	Special, slug-tuned	L9-9739A	Kay Electric Co.
M1	Meter, 0-200 μa	8050	Kay Electric Co.
PLUGS:			
P1	AC line cord, 3 wire	7166-1	Belden 172375 6 FT
P2 thru P8	Not Used		
P9 thru P13	Part of PC Board	------	----------
P14 thru P18	UG88/U, coax	6909-76	Dage UG88/U
TRANSISTORS:			
Q1	2N1141 (5)	K-127-5	Kay Electric Co.
Q2	2N1141 (4)	K-127-4	Kay Electric Co.
Q3 thru Q7	40235	K-193	RCA 40235
Q8 & Q9	2N3866	K-170	Motorola 2N3866
Q10	2N1141	K-127-5	Kay Electric Co.
Q11	MM1941	K-157	Motorola MM1941
Q12	40235	K-193	RCA 40235
Q13	MM1941	K-157	Motorola MM1941
RESISTORS: (Unless otherwise indicated, all components are fixed composition, ¼ watt, 10% tolerance)			
R1	1K, ½ watt	1021-E	Allen Bradley EB1021
R2	4.7K, ½ watt	4721-E	Allen Bradley EB4721
R3	See coil L1	-------	----------
R4	330	3311-C	Allen Bradley CB3311
R5 & R6	4.7K	4721-C	Allen Bradley CB4721

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R7	1K, ½ watt	1021-E	Allen Bradley EB1021
R8	4.7K, ½ watt	4721-E	Allen Bradley EB4721
R9	See Coil L2	-------	----------
R10	Special, wound on R9, 5.6K, ¼w	L2-9739	Kay Electric Co.
R11 & R12	330	3311-C	Allen Bradley CB3311
R13	51	5101-C	Allen Bradley CB5101
R14	15	1501-C	Allen Bradley CB1501
R15	47	4701-C	Allen Bradley CB4701
R16	See Coil L4	-------	----------
R17	47	4701-C	Allen Bradley CB4701
R18	See Coil L5	-------	----------
R19	47	4701-C	Allen Bradley CB4701
R20	220	2211-C	Allen Bradley CB2211
R21 & R22	5.6K	5621-C	Allen Bradley CB5621
R23	10, ½ watt	1001-E	Allen Bradley CB1001
R24	100	1011-C	Allen Bradley CB1011
R25	8.2, 5% tol.	8P25-C	Allen Bradley CB82G5
R26	47	4701-C	Allen Bradley CB4701
R27	2.2K	2221-C	Allen Bradley CB2221
R28 & R29	5.6K	5621-C	Allen Bradley CB5621
R30	10, ½ watt	1001-E	Allen Bradley CB1001
R31	100	1011-C	Allen Bradley CB1011
R32	8.2, 5% tol.	8P25-C	Allen Bradley CB82G5
R33	47	4701-C	Allen Bradley CB4701
R34	2.2K	2221-C	Allen Bradley CB2221
R35	50K, 2 watt pot, variable	117	Allen Bradley JA2N0485503UE
R36 & R37	5.6K	5621-C	Allen Bradley CB5621
R38	10, ½ watt	1001-E	Allen Bradley CB1001
R39	100	1011-C	Allen Bradley CB1011
R40	39	3901-C	Allen Bradley CB3901
R41	47	4701-C	Allen Bradley CB4701
R42	2.2K	2221-C	Allen Bradley CB2221
R43 & R44	5.6K	5621-C	Allen Bradley CB5621
R45	10, ½ watt	1001-E	Allen Bradley DB1001
R46	100	1011-E	Allen Bradley CB4701
R47	47	4701-C	Allen Bradley CB4701
R48	2.2K	2221-C	Allen Bradley CB2221
R49	4.7K	4721-C	Allen Bradley CB4721
R50	3.9K	3921-C	Allen Bradley CB2921
R51	10, ½ watt	1001-C	Allen Bradley CB1001
R52	100	1011-C	Allen Bradley CB1011
R53	12	1201-C	Allen Bradley CB1201
R54	47	4701-C	Allen Bradley CB4701
R55	1.8K	1821-C	Allen Bradley CB1821
R56	3.3K	3321-C	Allen Bradley CB3321
R57	5.6K	5621-C	Allen Bradley CB5621
R58	10, ½ watt	1001-E	Allen Bradley CB1001
R59	470	4711-C	Allen Bradley CB4711
R60	120	1211-C	Allen Bradley CB1211
R61	470	4711-C	Allen Bradley CB4711
R62	8.2, 5% tol.	8P25-C	Allen Bradley CB82G5
R63	47	4701-C	Allen Bradley CB4701
R64	2.7K	2721-C	Allen Bradley CB2721
R65	7.5K, 5% tol.	7525-C	Allen Bradley CB7525
R66	270	2711-C	Allen Bradley CB2711
R67	10, ½ watt	1001-E	Allen Bradley CB1001
R68	270	2711-C	Allen Bradley CB2711
R69	120	1211-C	Allen Bradley CB1211
R70	8.2, 5% tol.	8P25-C	Allen Bradley CB82G5
R71	100	1011-C	Allen Bradley CB1011
R72	1.5K	1521-C	Allen Bradley CB1521
R73	560	5611-C	Allen Bradley CB5611
R74	1.5K	1521-C	Allen Bradley CB1521
R75	10, ½ watt	1001-E	Allen Bradley CB1001
R76	270	7527-C	Allen Bradley CB7525
R77	470	4711-C	Allen Bradley CB4711
R78	150	1511-C	Allen Bradley CB1511
R79	50, 1% tol.	6558-273	Mepco Type C10-50
*R79	74.0, 1% tol.	6558-151	Mepco Type C10-74.0
R80	52.8, 1% tol.	6558-142	Mepco Type C10-52.8
*R80	79.2, 1% tol.	6558-274	Mepco Type C10-79.2

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
NOTE: *USED ON 75 OHM UNITS			
R81	82	8201-C	Allen Bradley CB8201
R82	560	6511-C	Allen Bradley CB5611
R83	6.8K	6821-C	Allen Bradley CB6821
R84	3.9K	3921-C	Allen Bradley CB4721
R85	470	4711-C	Allen Bradley CB4711
R86	330	3311-C	Allen Bradley CB3311
R87	15K	1531-C	Allen Bradley CB1531
R88	4.7K	4721-C	Allen Bradley CB4721
R89	100	1011-C	Allen Bradley CB1011
R90	1K, $\frac{1}{2}$ watt	1021-E	Allen Bradley EB1021
R91	10K	1031-C	Allen Bradley CB1031
R92	220	2211-C	Allen Bradley CB2211
R93	68	6801-C	Allen Bradley CB6801
R94	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley CB1001
R95	Not Used		
R96	100K/10K, 2 watt dual pot	7977	Allen Bradley
R97	100K/10K, 2 watt dual pot	7977	Allen Bradley
R98	560, $\frac{1}{2}$ watt	5611-E	Allen Bradley EB5611
R99	500, 2 watt pot, variable	100	Allen Bradley JA2N048S501UE
R100	1K, 3 turns, Helipot	7725	Helipot Model C
R101-	2K, 2 watt pot, variable	105	Allen Bradley JA2N048S202UE
R102	5K, 2 watt pot, variable	142	Allen Bradley JA2N048S502UE
R103	10K, 2 watt pot, variable	108	Allen Bradley JA2N048S103UE
R104 & R105	1 MEG, 2 watt pot, variable	130	Allen Bradley JA2N048S105UE
SWITCHES:			
S1	Rotary, 3 wafer, 5 position	8377-C	Kay Electric Co.
S2	Rotary, 2 wafer, 5 position	9763	Kay Electric Co.
S3 & S4	Toggle, DPDT	254-A	A-H&H 81027-CE
S5	Toggle, SPST	255-A	A-H&H 21350-CF
S6	Toggle, DPDT	254-A	A-H&H 81027-CE
S7	Toggle, SPST	255-A	A-H&H 21350-CF
T1	Transformer, power	9614	Kay Electric Co.

PARTS LIST - POWER SUPPLY, P.C. BOARD #1, DWG. NO. 9739

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1	1 μf, 200V, mylar	6411-21	Electro Cube 212A1B105K
C2	.01 μf, 100V, mylar paper	6899-12	Elmenco 1 DP-1-103
C3	10 μf, 25V, electrolytic	6355-94	Sprague Type 40D
C4	.25 μf, 100V, mylar paper	6899-20	Elmenco 1DP-3-254
C5	2.2 μf, 50V, electrolytic	6355-128	G.E. 76F02LC2R2
C6	33 μf, 50V, electrolytic	6355-132	G.E. 76F02LL339
C7	33 μf, 50V, electrolytic	6355-132	G.E. 76F02LL339
C8	.05 μf, 100V, mylar paper	6899-1	Elmenco 1DP-2-503
C9	2.2 μf, 50V, electrolytic	6355-128	G.E. 76F02LC2R2
C10	33 μf, 50V, electrolytic	6355-132	G.E. 76F02LL339
C11	18 μf, 100V, electrolytic	6355-73	Sprague Type 40D
DIODES:			
D1	Silicon recitifier - F6	6357-3	Sarkes Tarzian F6
D2	Silicon recitifier - F6	6357-3	Sarkes Tarzian F6
D3	Silicon 1N461	6357-57	Texas - 1N461
D4	1N4756, Zener	6357-100	Motorola 1N4756
D5	1N936TC, Zener	6357-103	Motorola 1N936TC
D6 thru D9	Silicon recitifier F6	6357-3	Sarkes Tarzian F6
D10	Silicon 1N461	6357-57	Texas 1N461
D11	1N4736 Zener	6357-98	Motorola 1N4736
D12	Silicon 1N461	6357-57	Texas 1N461
TRANSISTORS:			
Q1	40322	K-191	RCA 40322
Q2	2N3566	K-159	Fairchild 2N3566
Q3	2N3566	K-159	Fairchild 2N3566
Q4	2N3569	K-179	Fairchild 2N3569
Q5	2N3569	K-179	Fairchild 2N3569

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
Q6	40250	K-160	RCA 40250
Q7	2N3566	K-159	Fairchild 2N3566
Q8	2N2270	K-132	RCA 2N2270
Q9	2N3740	K-190	Motorola 2N3740
Q10 thru Q12	2N3645	K-189	Fairchild 2N3645

RESISTORS: (Unless indicated all resistances are in ohms, $\frac{1}{2}$ watt, 10% tolerance)

R1	91K, 5% tolerance	9135-E	Allen Bradley EB9135
R2	91K, 5% tolerance	9135-E	Allen Bradley EB9135
R3	12K	1231-E	Allen Bradley EB1231
R4	250 ohm, 5 watt	2511-J	Ward Leonard 5XM 250
R5	7.5 ohm, 5% tolerance	7P55-E	Allen Bradley EB7G55
R6	470 ohm	4711-E	Allen Bradley EB4711
R7	2.2K	2221-E	Allen Bradley EB2221
R8	4.7K	4721-E	Allen Bradley EB4721
R9	10K	1031-E	Allen Bradley EB1031
R10	3.9K	3921-E	Allen Bradley EB3821
R11	10K	1031-E	Allen Bradley EB1031
R12	27K, 5% tolerance	9292-15	Corning Type C5
R13	1K, 2K, 5K, pot variable	9167-1	Kay Electric Co.
R14	4.3K, 5% tolerance	9292-12	Corning Type C5
R15	33K, 5% tolerance	3335-E	Allen Bradley EB3335
R16	39K, 5% tolerance	3935-E	Allen Bradley EB3935
R17	2.2 ohm, 1 watt, 5% tolerance	9292-18	I.R.C. Type BWH
R18	470 ohm	4711-E	Allen Bradley EB4711
R19	3.9K	3921-E	Allen Bradley EB3921
R20	3.3K	3321-E	Allen Bradley EB3321
R21	330 ohm	3311-E	Allen Bradley EB3311
R22	7.5K, 5% tolerance	9292-16	Corning Type C5
R23	1K, 2K, 5K, pot variable	9167-1	Kay Electric Co.
R24	2.4K, 5% tolerance	9292-11	Corning Type C5
R25	4.7 ohm, 1 watt, 5% tolerance	9292-19	I.R.C. Type BWH
R26	2.2K	2221-E	Allen Bradley EB2221
R27	100 ohm	1011-E	Allen Bradley EB1011
R28	4.7K	4721-E	Allen Bradley EB4721
R29	36K, 5% tolerance	3635-E	Allen Bradley EB3635
R30	39K, 5% tolerance	3935-E	Allen Bradley EB3935
R31	8.2K	8221-E	Allen Bradley EB8221
R32	470 ohm	4711-E	Allen Bradley EB4711
R33	2 ohm, 1 watt, 5% tolerance	9292-20	IRC Type BWH
R34	330 ohm	3311-E	Allen Bradley EB3311
R35	5.6K, 5% tolerance	9292-13	Corning Type C5
R36	1K, 2K, 5K, pot variable	9167-1	Kay Electric Co.
R37	330 ohm	3311-E	Allen Bradley EB3311
R38	10 ohm, 5 watt W/W	9292-21	Ward Leonard 5XM10
R39	12K, 5% tolerance	9292-15	Corning Type C5

PARTS LIST - BIRDIE MARKER AMP., P.C. BOARD #2 - DWG. NO. B9686

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1	.005 μf, 100V, mylar paper	6899-14	Elmenco 1DP-1-502
C2	0.1 μf, 100V, mylar paper	6899-11	Elmenco 1DP-2-104
C3	0.1 μf, 100V, mylar paper	6899-11	Elmenco 1DP-2-104
C4	.005 μf, 100V, mylar paper	6899-14	Elmenco 1DP-1-502
C5	.005 μf, 100V, mylar paper	6899-14	Elmenco 1DP-1-502
C6	0.1 μf, 100V, mylar paper	6899-11	Elmenco 1DP-2-104
C7	.005 μf, 100V, mylar paper	6899-14	Elmenco 1DP-1-502
C8	50 pf, 500V, silver mica	6359-50	Elmenco D15-500
C9	.05 μf, 100V, mylar paper	6899-1	Elmenco 1DP-2-503
C10	.002 μf, 600V, mylar paper	6899-4	Elmenco 6DP-1-202
C11	250 μf, 500V, silver mica	6359-75	Elmenco DM15-251
C12	2.2 μf, 50V, electrolytic	6355-128	G.E. 76F02LC2R2
DIODES:			
D1	1N461, silicon	6357-57	Texas 1N461
D2	1N461, silicon	6357-57	Texas 1N461

TRANSISTORS:

Q1 thru Q3	Transistor - 2N3565	K-173	Fairchild 2N3565
Q4	Transistor - 2N2270	K-132	RCA 2N2270

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R1	1K	1021-E	Allen Bradley EB1021
R2	150K	1541-E	Allen Bradley EB1541
R3	68K, 5% tolerance	6835-E	Allen Bradley EB6835
R4	33K	3331-E	Allen Bradley EB3331
R5	100K	1041-E	Allen Bradley EB1041
R6	100	1011-E	Allen Bradley EB1011
R7	47K	4731-E	Allen Bradley EB4731
R8	270K	2741-E	Allen Bradley EB2741
R9	10K	1031-E	Allen Bradley EB1031
R10	100	1011-E	Allen Bradley EB1011
R11	2.2K	2221-E	Allen Bradley EB2221
R12	22K	2231-E	Allen Bradley EB2231
R13	120K, 5% tolerance	1245-E	Allen Bradley EB1245
R14	620 ohm, 5% tolerance	6215-E	Allen Bradley EB6215
R15	2.7K	2721-E	Allen Bradley EB2721
R16	100K	1041-E	Allen Bradley EB1041
R17	68K, 5% tolerance	6835-E	Allen Bradley EB6835
R18	10K	1031-E	Allen Bradley EB1031
R19	30K, 5% tolerance	3035-E	Allen Bradley EB3035
R20	62K, 5% tolerance	6235-E	Allen Bradley EB6235
R21	15K	1531-E	Allen Bradley EB1531
R22	47K	4721-E	Allen Bradley EB4731
R23	47K	4731-E	Allen Bradley EB1231
R24	12K	1231-E	Allen Bradley EB1231
R25	2K, 5% tolerance	2025-E	Allen Bradley EB2025

PARTS LIST - SWEEP VOLTAGE GENERATOR, P.C. BOARD #3 - DWG. NO. C9687

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1	.01 μf, 100V, mylar paper	6899-12	Elmenco 1DP-1-103
C2	.001 μf, 600V, mylar paper	6899-10	Elmenco 6DP-1-102
DIODES:			
D1 & D2	1N4742, Zener	6357-107	Motorola 1N4742
TRANSISTORS:			
Q1 & Q2	2N1308	K-133	Texas 2N1308
Q3	SE4002	K-192	Fairchild SE4002
Q4	2N3645	K-189	Fairchild 2N3645
Q5 & Q6	2N3638A	K-178	Fairchild 2N3638A
Q7	2N3566	K-159	Fairchild 2N3566
Q8	2N3568	K-187	Fairchild 2N3568
Q9	2N1377	K-134	Texas 2N1377
Q10	2N3645	K-189	Fairchild 2N3638A
Q11	2N3645	K-189	Fairchild 2N3645
RESISTORS: (Unless indicated all components are fixed composition, ½ watt, 10% tolerance)			
R1	3.3K	3321-E	Allen Bradley EB3321
R2	1K	1021-E	Allen Bradley EB1021
R3	18K	1831-E	Allen Bradley EB1831
R4	470	4711-E	Allen Bradley EB4711
R5	62K, 5% tolerance	6235-E	Allen Bradley EB6235
R6	100	1011-E	Allen Bradley EB1011
R7	470K	4741-E	Allen Bradley EB4741
R8	100	1011-E	Allen Bradley EB1011
R9	6.8K	6821-E	Allen Bradley EB6821
R10	8.2K	8221-E	Allen Bradley EB8221

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R11	15K	1531-E	Allen Bradley EB1531
R12	5.6K	5621-E	Allen Bradley EB5621
R13	100	1011-E	Allen Bradley EB1011
R14	2K, 25K, pot variable	9718-1	Kay Electric Co.
R15	8.2K	8221-E	Allen Bradley EB8221
R16	1.8K	1821-E	Allen Bradley EB1821
R17	820	8211-E	Allen Bradley EB8211
R18	220	2211-E	Allen Bradley EB2211
R19	5.6K	5621-E	Allen Bradley EB5621
R20	1.2K	1221-E	Allen Bradley EB1221
R21	3.3K	3321-E	Allen Bradley EB3321
R22	10K	1031-E	Allen Bradley EB1031
R23	10K	1031-E	Allen Bradley EB1031
R24	2K, 25K, pot variable	9718-1	Kay Electric Co.
R25	100	1011-E	Allen Bradley EB1011
R26	22K	2231-E	Allen Bradley EB2231
R27	56K	5631-E	Allen Bradley EB5631
R28	22K	2231-E	Allen Bradley EB2231
R29	7.5K, 5% tolerance	7527-E	Allen Bradley EB7525
R30	3K, 5% tolerance	3025-E	Allen Bradley EB3025
R31	220	2211-E	Allen Bradley EB2211
R32	3.9K	3921-E	Allen Bradley EB3931
R33	9.1K, 5% tolerance	9125-E	Allen Bradley EB9125

PARTS LIST - SWEEP AMPLIFIER & LINEARITY, P.C. BOARD #4 - DWG. NO. C9688

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1	18 μf, 100V, electrolytic	6355-73	Sprague Type 40D
C2	33 μf, 50V, electrolytic	6355-132	G.E. 76F02LL339
DIODES:			
D1 & D2	1N461 - silicon	6357-57	Texas 1N461
TRANSISTORS:			
Q1 & Q2	2N3568	K-187	Fairchild 2N3568
RESISTORS:			
R1	2K, 500, 250K, 5K, pot variable	9717-2	Kay Electric Co.
R2	4.3K, 5% tolerance	4325-E	Allen Bradley EB4325
R3	680K	6841-E	Allen Bradley EB6841
R4	3K, 5% tolerance	3025-E	Allen Bradley EB3025
R5	3K, 5% tolerance	3025-E	Allen Bradley EB3025
R6	1K	1021-E	Allen Bradley EB1021
R7	6.8K	6821-E	Allen Bradley EB6821
R8	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R9	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R10	82K	8231-E	Allen Bradley EB8231
R11	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R12	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R13	39K, 2 watt	3931-H	Allen Bradley HB3931
R14	39K, 2 watt	3931-H	Allen Bradley HB3931
R15	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R16	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R17	82K	8231-E	Allen Bradley EB8231
R18	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R19	25K, 10K, 500K, 100K, pot var.	9717-1	Kay Electric Co.
R20	6.8K	6821-E	Allen Bradley EB6821
R21	2K, 500, 250K, 5K, pot variable	9717-2	Kay Electric Co.
R22	220K	2241-E	Allen Bradley EB2241
R23	680	6811-E	Allen Bradley EB6811
R24	680	6811-E	Allen Bradley EB1231
R25	12K	1231-E	Allen Bradley EB1231
R26	2K, 500, 250K, 5K, pot variable	9717-2	Kay Electric Co.
R27	470	4711-E	Allen Bradley EB4711
R28	6.8K	6821-E	Allen Bradley EB6821
R29	330	3311-E	Allen Bradley EB3311

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R30	2K, 500, 250K, 5K, pot variable	9717-2	Kay Electric Co.
R31	1.2K	1221-E	Allen Bradley EB1221
R32	750, 5% tolerance	7515-E	Allen Bradley EB7515

PARTS LIST - P.C. BOARD # 5 ALC - DWG. NO. D9689

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1	.02 μf, 100V, mylar paper	6899-13	Elmenco 1DP-1-203
C2	.01 μf, 100V, mylar paper	6899-12	Elmenco 1DP-1-102
C3	250 pf, 500V, silver mica	6359-75	Elmenco DM15-251
C4	.02 μf, 100V, mylar paper	6899-13	Elmenco 1DP-1-203
C5	.02 μf, 100V, mylar paper	6355-94	Elmenco 1DP-1-203
C6	10 μf, 25V, electrolytic	6355-94	Sprague Type 40D
C7	1 μf, 200V, mylar	6411-21	Electro Cube 212A1B105K
C8	47 μf, 25V, electrolytic	6355-127	G.E. 76F02KK470
CONNECTORS:			
J1 thru J6	Not Used		
J7	Connectors UG625/U	6909-81	Speciality Conn. Co. 28JR121-2
TRANSISTORS:			
Q1	Transistor 2N3566	K-159	Fairchild, 2N3566
Q2	Transistor 2N3645	K-189	Fairchild, 2N3645
Q3 thru Q5	Transistor 2N3566	K-159	Fairchild, 2N3566
Q6	Transistor 2N3569	K-179	Fairchild, 2N3569
RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)			
R1	100K	1041-E	Allen Bradley EB1041
R2	1K	1021-E	Allen Bradley EB1021
R3	10K	1031-E	Allen Bradley EB1031
R4	4.7K	4721-E	Allen Bradley EB4721
R5	100K	1041-E	Allen Bradley EB1041
R6	500K, pot "A" taper	9122-58	Allen Bradley JA2N048S504AE
R7	1.2K	1221-E	Allen Bradley EB1221
R8	10K, 5K, pot variable	9718-2	Kay Electric Co.
R9	1K	1021-E	Allen Bradley EB1021
R10	5.6K	5621-E	Allen Bradley Eb5621
R11	10K	1031-E	Allen Bradley EB1031
R12	10K	1031-E	Allen Bradley EB1031
R13	33K	3331-E	Allen Bradley EB3331
R14	33K	3331-E	Allen Bradley EB3331
R15	300, 5% tolerance	3015-E	Allen Bradley EB3331
R16	10K, 5K, pot variable	9718-2	Kay Electric Co.
R17	30K, 5% tolerance	3035-E	Allen Bradley EB3035
R18	220	2211-E	Allen Bradley EB2211
R19	510, 5% tolerance	5115-E	Allen Bradley EB5115
R20	3.9K	3921-E	Allen Bradley EB3921
R21	3.3K	3321-E	Allen Bradley EB3321
R22	1K	1021-E	Allen Bradley EB1021
R23	2.2K	2221-E	Allen Bradley EB2221
R24	4.7, 5% tolerance	4P75-E	Allen Bradley EB4P75
R25	47	4701-E	Allen Bradley EB4701
R26	12	1201-E	Allen Bradley EB1201
R27	3.9K	3921-E	Allen Bradley EB3921
R28	2.7K	2721-E	Allen Bradley EB2721
R29	220	2211-E	Allen Bradley EB2211
SWITCHES:			
S1	Switch, toggle, DPDT	254-A	A-H&H - 81027-CE

PARTS LIST - ATTENUATOR (50 & 75 ohms) -

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
ENTIRE ATTENUATOR	ATTENUATOR, 50 ohm	8275-50	Kay Electric Co.

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
ENTIRE ATTENUATOR	ATTENUATOR, 75 ohm	8275-75	Kay Electric Co.

NOTE: Part with + mark are for 50 ohm Attenuator only.
Part with * mark are for 75 ohm Attenuator only.

CAPACITORS:

C1 thru C6 +	1.5 μμf, 500V, ceramic	6361-35	Quality Component QC 1.5
C1 thru C6 *	.75 μμf, 500V, ceramic	6361-37	Quality Component QC .75
C7 *	.47 μμf, 500V, ceramic	6361-43	Quality Component QC .47
C8 *	1.8 μμf, 500V, ceramic	6361-59	Quality Component QC 1.8
C9 *	3.3 μμf, 500V, ceramic	6361-32	Quality Component QC 3.3

CONNECTORS:

J15 & J16 + *	Coax, UG535/U	6909-80	Dage UG535/U

RESISTORS: (Unless otherwise specified, all components are fixed composition, ¼ watt, 1% tolerance)

R1 + *	150 ohm, 10% tolerance	1511-C	Allen Bradley CB1511
R2 +	61.1 ohms	6558-97	Mepco Type C10-61.1
R2 *	92.35 ohms	6558-254	Mepco Type C92.35
R3 +	248 ohms	6558-98	Mepco Type C10-248
R3 *	372 ohms	6558-255	Mepco Type C10-372
R4 +	61.1 ohms	6558-97	Mepco Type C10-61.1
R4 *	92.35 ohms	6558-254	Mepco Type C10-9235
R5 & R6 + *	150 ohms, 10% tolerance	1511-C	Allen Bradley CB1511
R7 +	61.1 ohms	6558-97	Mepco Type C10-61.1
R7 *	92.35 ohms	6558-254	Mepco Type C10-92.35
R8 +	248 ohms	6558.98	Mepco Type C10-248
R8 *	372 ohms	6558-255	Mepco Type C10-372
R9 +	61.1 ohms	6558-97	Mepco Type C10-61.1
R9 *	92.35 ohm	6558-254	Mepco Type C10-9235
R10 & R11 + *	150 ohm, 10% tolerance	1511-C	Allen Bradley CB1511
R12 +	61.1 ohm	6558-97	Mepco Type C10-61.1
R12 *	92.35 ohm	6558-254	Mepco Type C10-92.35
R13 +	248 ohm	6558-98	Mepco Type C10-248
R13 *	372 ohm	6558-255	Mepco Type C10-372
R14 +	61.1 ohm	6558-97	Mepco Type C10-61.1
R14 *	92.35 ohm	6558-254	Mepco Type C10-92.35
R15 + *	150 ohm, 10% tolerance	1511-C	Allen Bradley CB1511
R16 +	96.15 ohm	6558-99	Mepco Type C10-96.15
R16 *	144 ohm	6558-256	Mepco Type C10-144
R17 +	71.17 ohm	6558-100	Mepco Type C10-71.17
R17 *	106.76 ohm	6558-257	Mepco Type C10-106.76
R18 +	96.15 ohm	6558-99	Mepco Type C10-96.15
R18 *	390 ohm, 10% tolerance	3911-C	Allen Bradley CB3811
R19 +	150.5 ohm	6558-59	Mepco Type C10-150.5
R19 *	144 ohm	6558-256	Mepco Type C10-144
R20 +	37.4 ohm	6558-58	Mepco Type C10-37.4
R20 *	226 ohm	6558-276	Mepco Type C10-226
R21 +	150.5 ohm	6558-59	Mepco Type C10-150.5
R21 *	56.1 ohm	6558-275	Mepco Type C10-56.1
R22 +	292 ohm	6558-101	Mepco Type C10-292
R22 *	100 ohm, 10% tolerance	1011-C	Allen Bradley CB1011
R23 +	17.63 ohm	6558-102	Mepco Type C10-17.63
R23 *	226 ohm	6558-276	Mepco Type C10-226
R24 +	292 ohm	6558-101	Mepco Type C10-292
R24 *	438 ohm	6558-259	Mepco Type C10-438
R25 *	26.45 ohm	6558-264	Mepco Type C10-26.45
R26 *	47 ohm, 10% tolerance	4701-C	Allen Bradley CB4701
R27 *	438 ohm	6558-259	Mepco Type C10-238

SWITCHES:

S1 thru S6 + *	Switch, toggle, DPDT	254-T	Kay Electric Co.

SCHEMATIC MANUAL
ISSUE A

JUNE 1968

MULTI-SWEEP
159-C
SCHEMATICS

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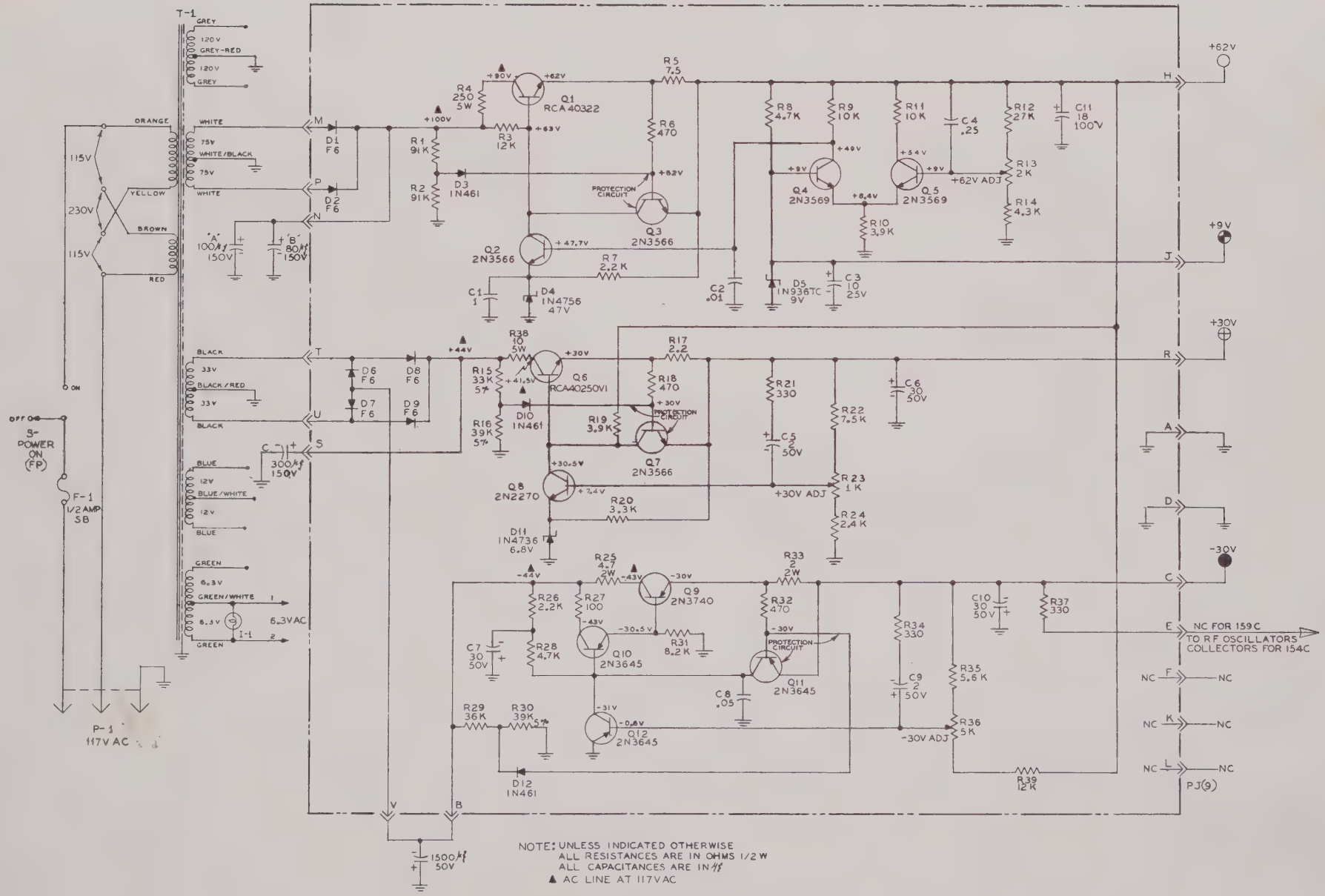
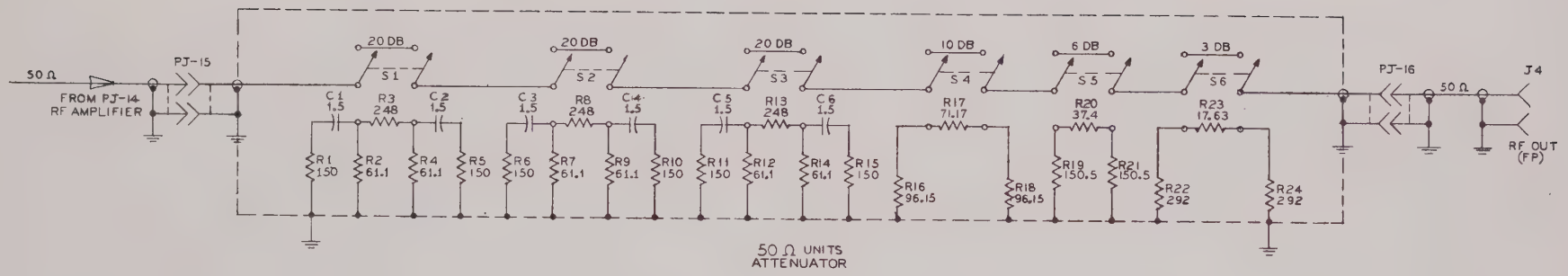
PINE BROOK, NEW JERSEY
201-227-2000

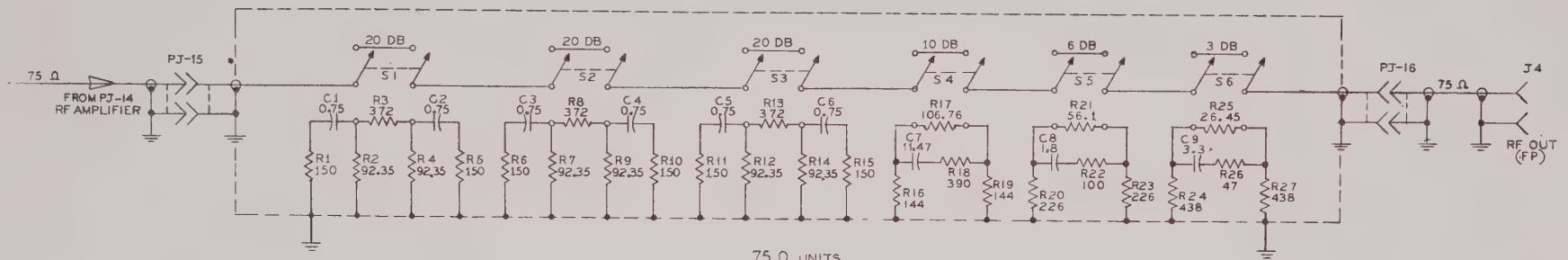


NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN µf
▲ AC LINE AT 117VAC

DWG. NO. C9685B P/C/B #1 [POWER SUPPLY]



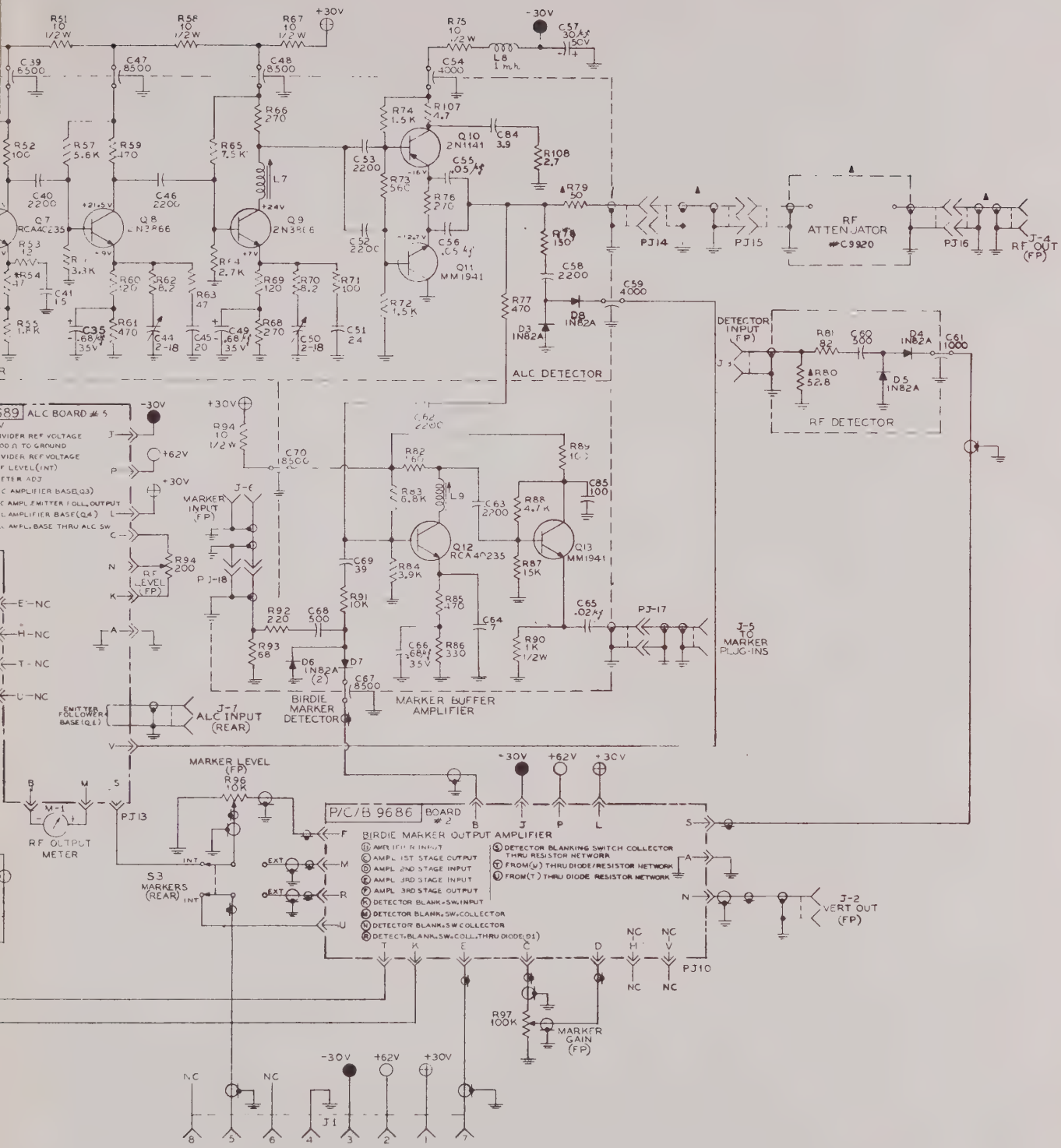
50 Ω UNITS
ATTENUATOR



75 Ω UNITS
ATTENUATOR

NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS-1/4 W
ALL CAPACITANCES ARE IN pf

DWG. NO. C9920A ATTENUATOR [50Ω/75Ω]

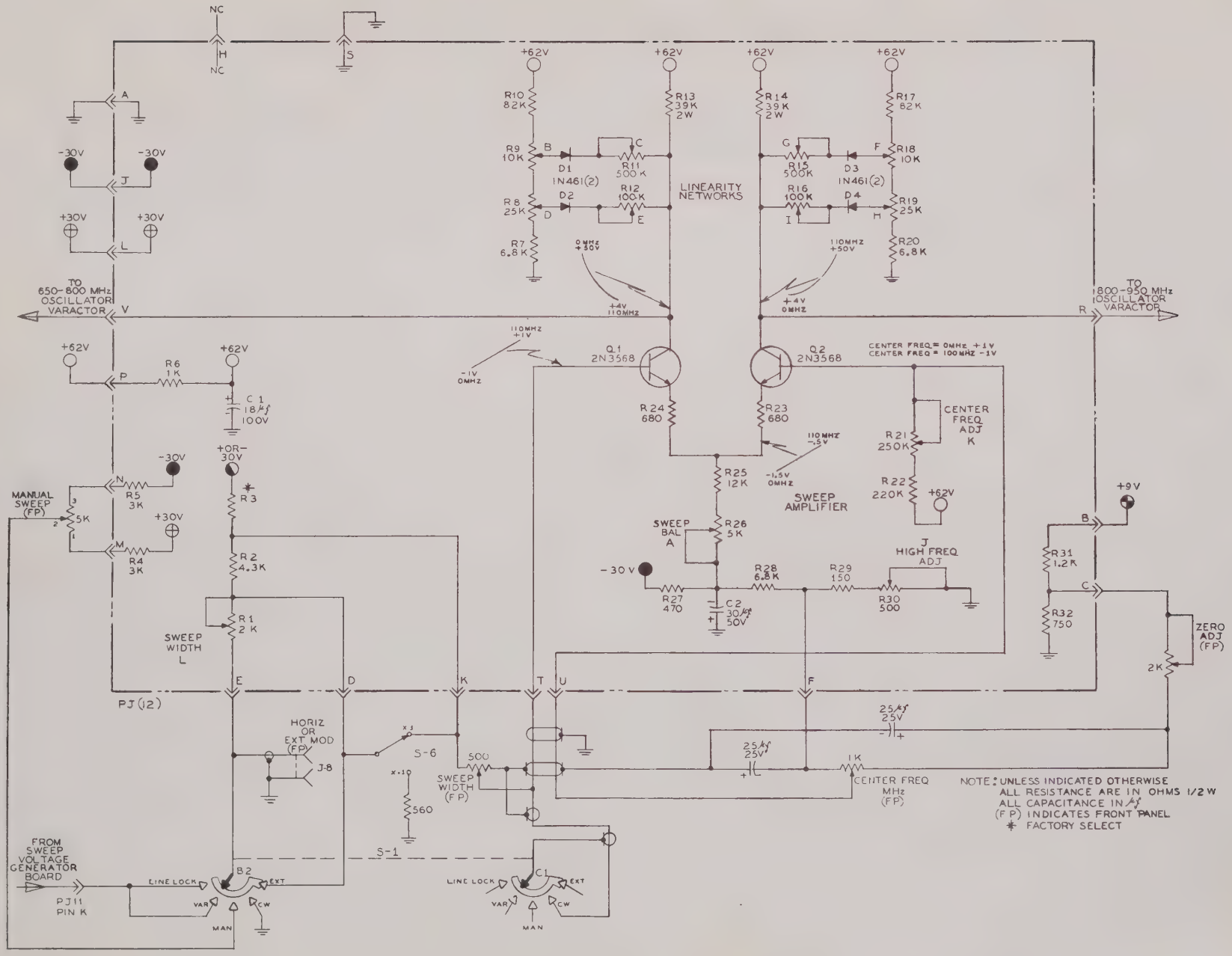


NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/4W
ALL CAPACITANCES ARE IN μF
* FACTORY SELECT

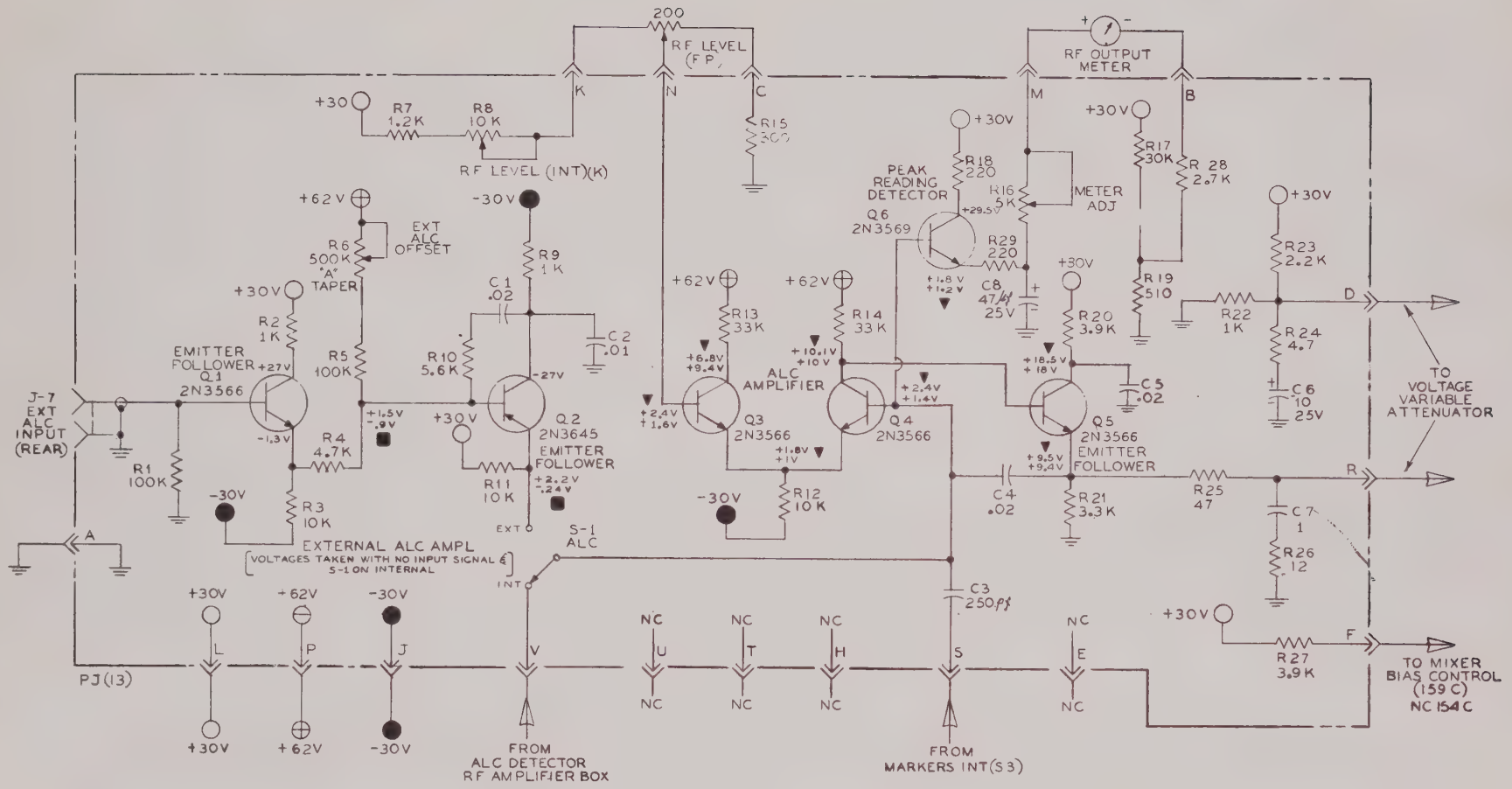
♦ INDICATES WHEN 75 Ω SYSTEM IS REQ:
RESISTORS (R79 = 74 Ω 1%) & (R80 = 79.2 Ω 1%)
ATTENUATOR BECOMES 75 Ω (DWG NOC9920)
MARKED CABLES BECOME 75 Ω

(FP) INDICATES FRONT PANEL

DWG. NO. D9739C MULTI-SWEEP 159C

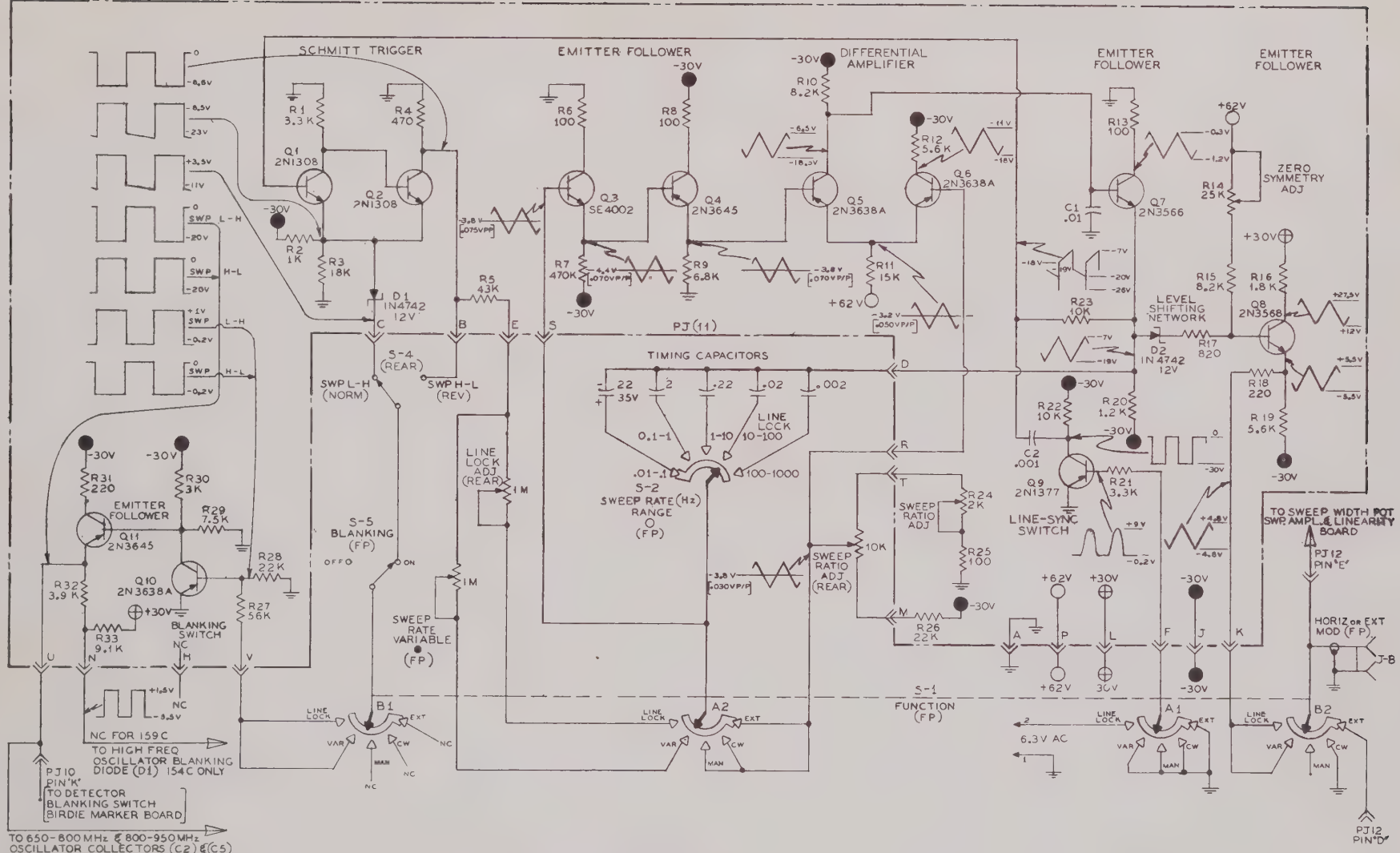


DWG. NO. C9688A P/C/B # 4 [SWP AMP & LINEARITY]



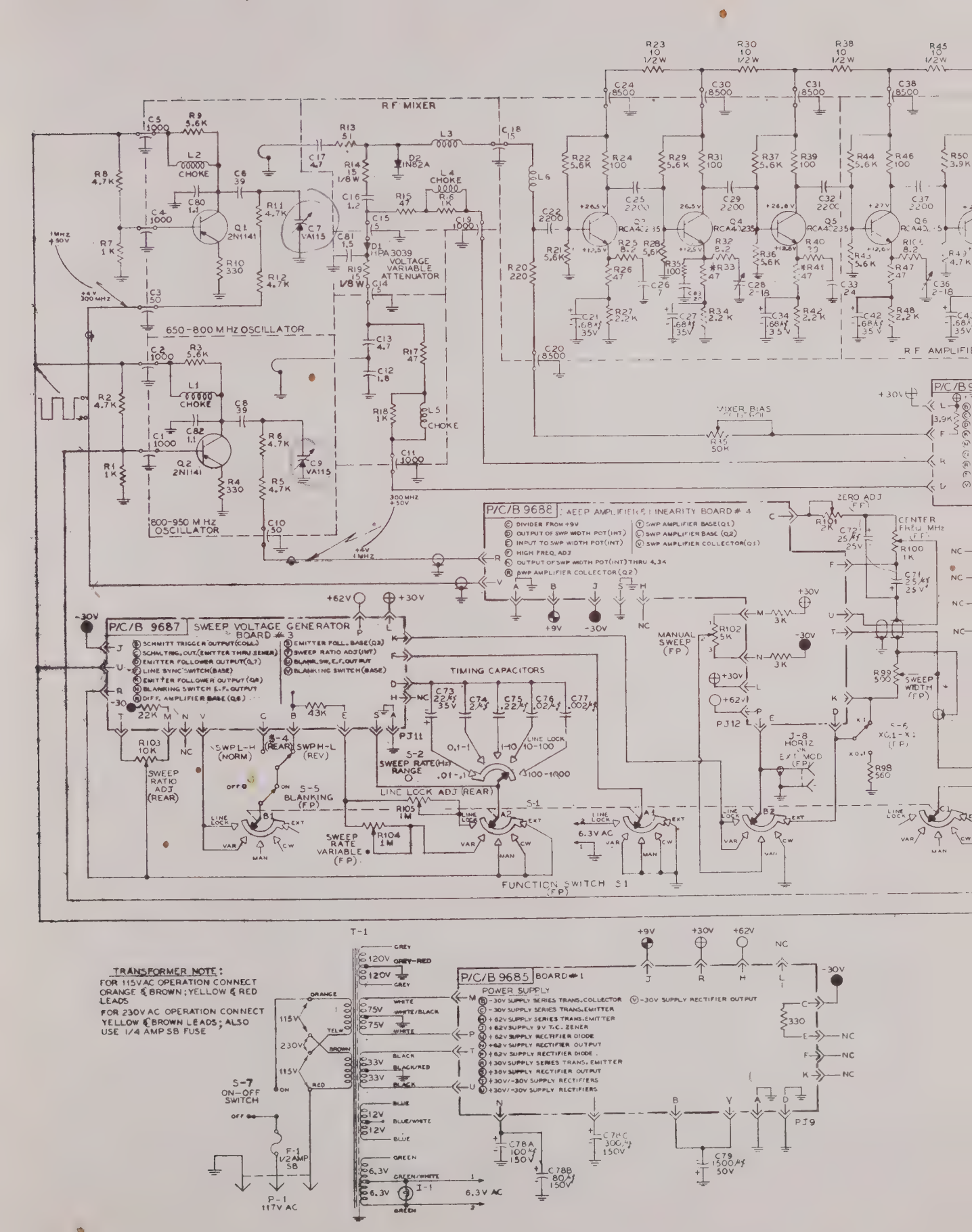
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCE IN µf
■ R6 MINIMUM (UPPER)
MAXIMUM (LOWER)
▼ RF LEVEL (FP)
MAXIMUM (UPPER)
-3DB (LOWER)
CONDITIONS OF MEASUREMENT
ALC (INT); CENTER FREQ. (50MHZ)
FUNCTION (CW)

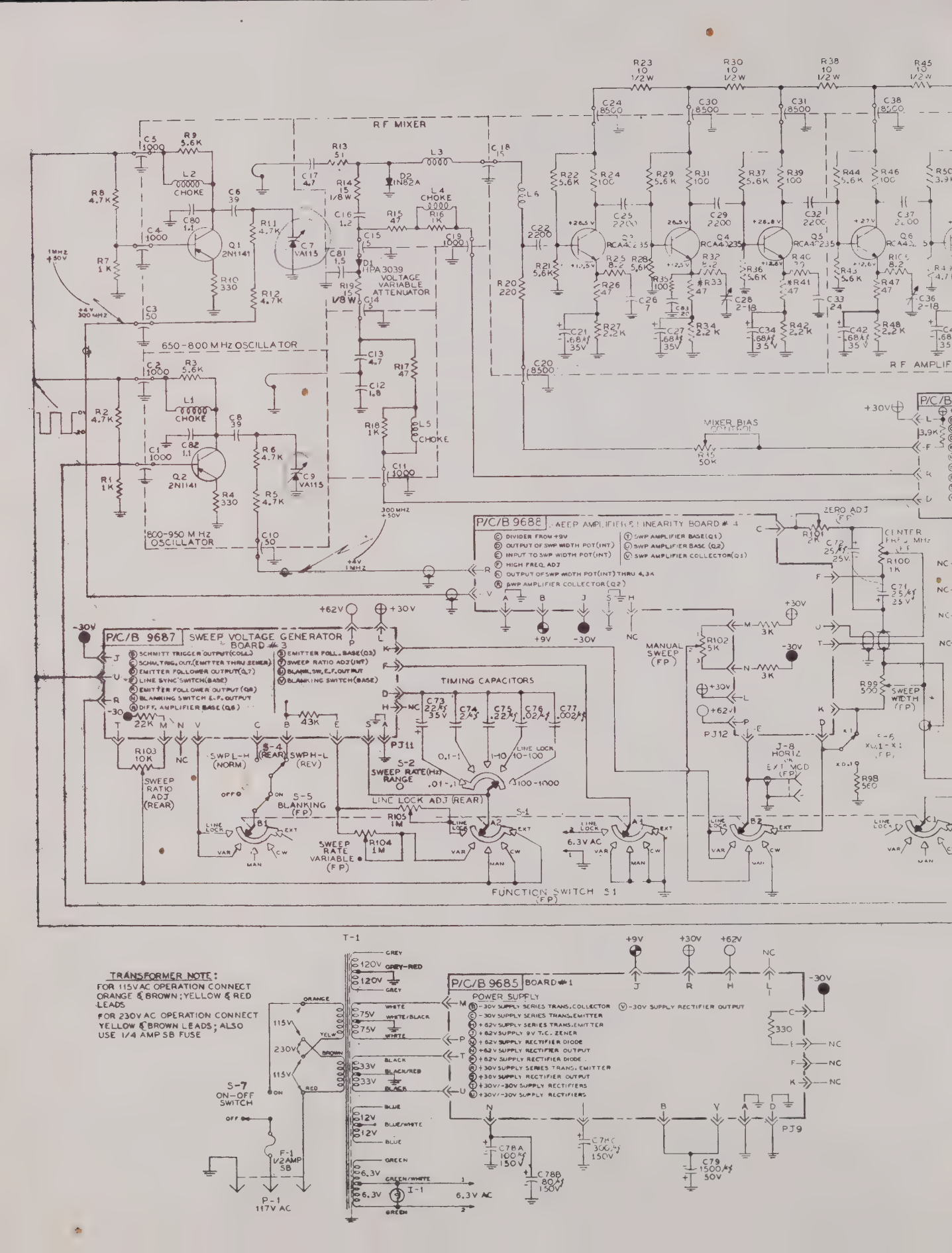
DWG. NO. B9689B P/C/B 5 — ALC.

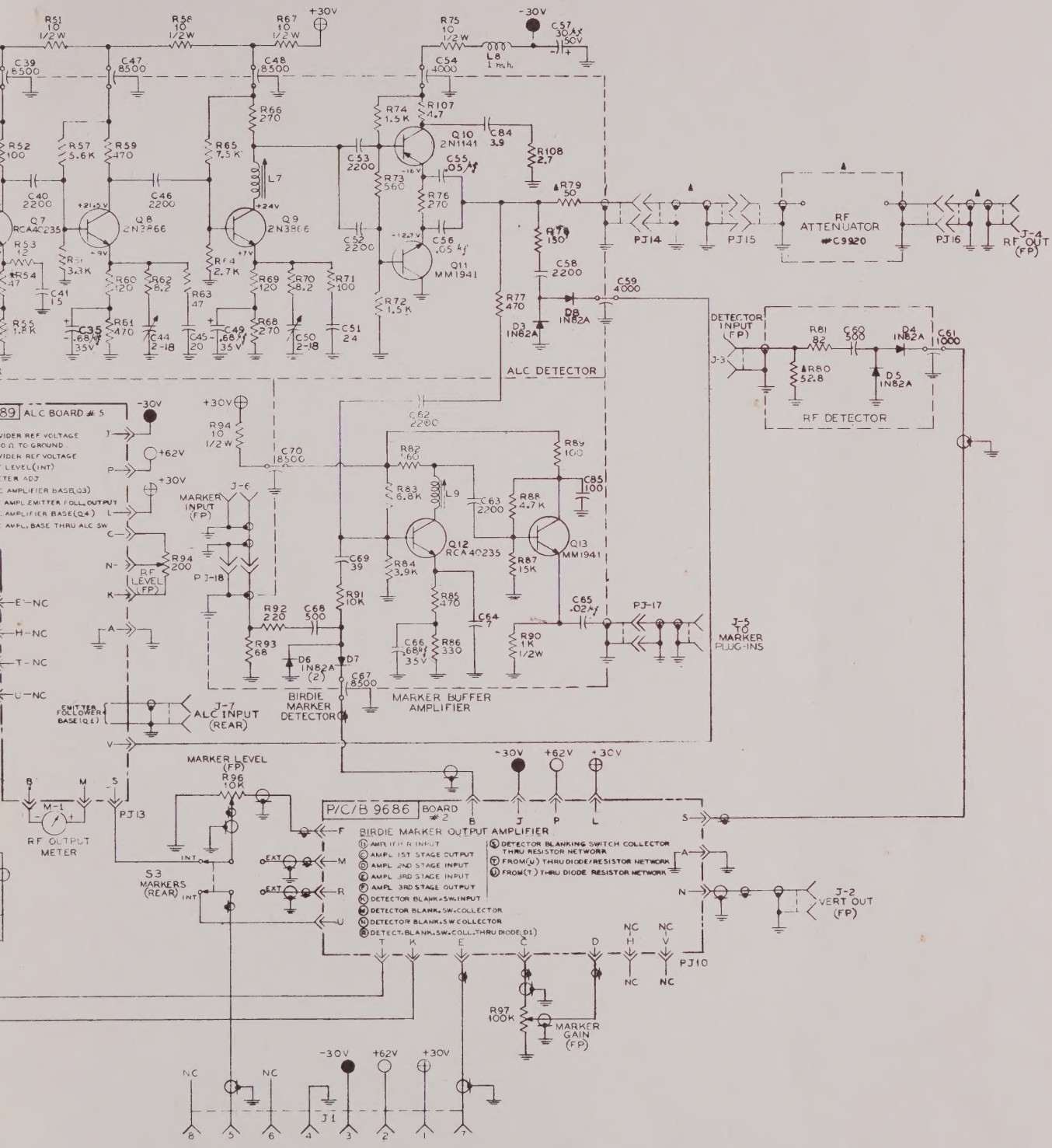


NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHM 1/2 W
ALL CAPACITANCE ARE μf
(FP) INDICATES FRONT PANEL

DWG. NO. C 96[illegible]7 D P/C/B#3 [SWP VOLTAGE GENERATOR]


RF MIXER
650-800 MHZ OSCILLATOR
800-950 MHZ OSCILLATOR
RF AMPLIFIE
P/C/B 9688 : AEEP AMPLIFIER LINEARITY BOARD # 4
P/C/B 9687 SWEEP VOLTAGE GENERATOR BOARD # 3
TIMING CAPACITORS
SWEEP RATIO ADJ (REAR)
SWPL-H (NORM)
SWPH-L (REV)
S-5 BLANKING (FP)
LINE LOCK ADJ (REAR)
SWEEP RATE VARIABLE (FP)
S-2 SWEEP RATE(Hz) RANGE
PJ11
PJ12
MANUAL SWEEP (FP)
ZERO ADJ (FP)
CENTER FREQ MHz (FP)
SWEEP WIDTH (FP)
J-8 HORIZ EXT MOD (FP)
FUNCTION SWITCH S1 (FP)
TRANSFORMER NOTE:
FOR 115VAC OPERATION CONNECT ORANGE & BROWN; YELLOW & RED LEADS
FOR 230V AC OPERATION CONNECT YELLOW & BROWN LEADS; ALSO USE 1/4 AMP SB FUSE
S-7 ON-OFF SWITCH
F-1 1/2 AMP SB
P-1 117V AC
P/C/B 9685 BOARD # 1
POWER SUPPLY
6.3V AC


RF MIXER
650-800 MHz OSCILLATOR
800-950 MHz OSCILLATOR
VOLTAGE VARIABLE ATTENUATOR
RF AMPLIF
MIXER BIAS
P/C/B 9688 SWEEP AMPLIFIER & LINEARITY BOARD # 4
P/C/B 9687 SWEEP VOLTAGE GENERATOR BOARD # 3
TIMING CAPACITORS
SWEEP RATE (Hz) RANGE
LINE LOCK ADJ (REAR)
SWEEP RATIO ADJ (REAR)
SWEEP RATE VARIABLE (FP)
BLANKING (FP)
MANUAL SWEEP (FP)
SWEEP WIDTH (FP)
FUNCTION SWITCH S1 (FP)
P/C/B 9685 BOARD # 1
POWER SUPPLY
TRANSFORMER NOTE:
FOR 115VAC OPERATION CONNECT ORANGE & BROWN; YELLOW & RED LEADS
FOR 230V AC OPERATION CONNECT YELLOW & BROWN LEADS; ALSO USE 1/4 AMP SB FUSE
S-7 ON-OFF SWITCH
P-1 117V AC
F-1 1/2 AMP SB
I-1
6.3V AC

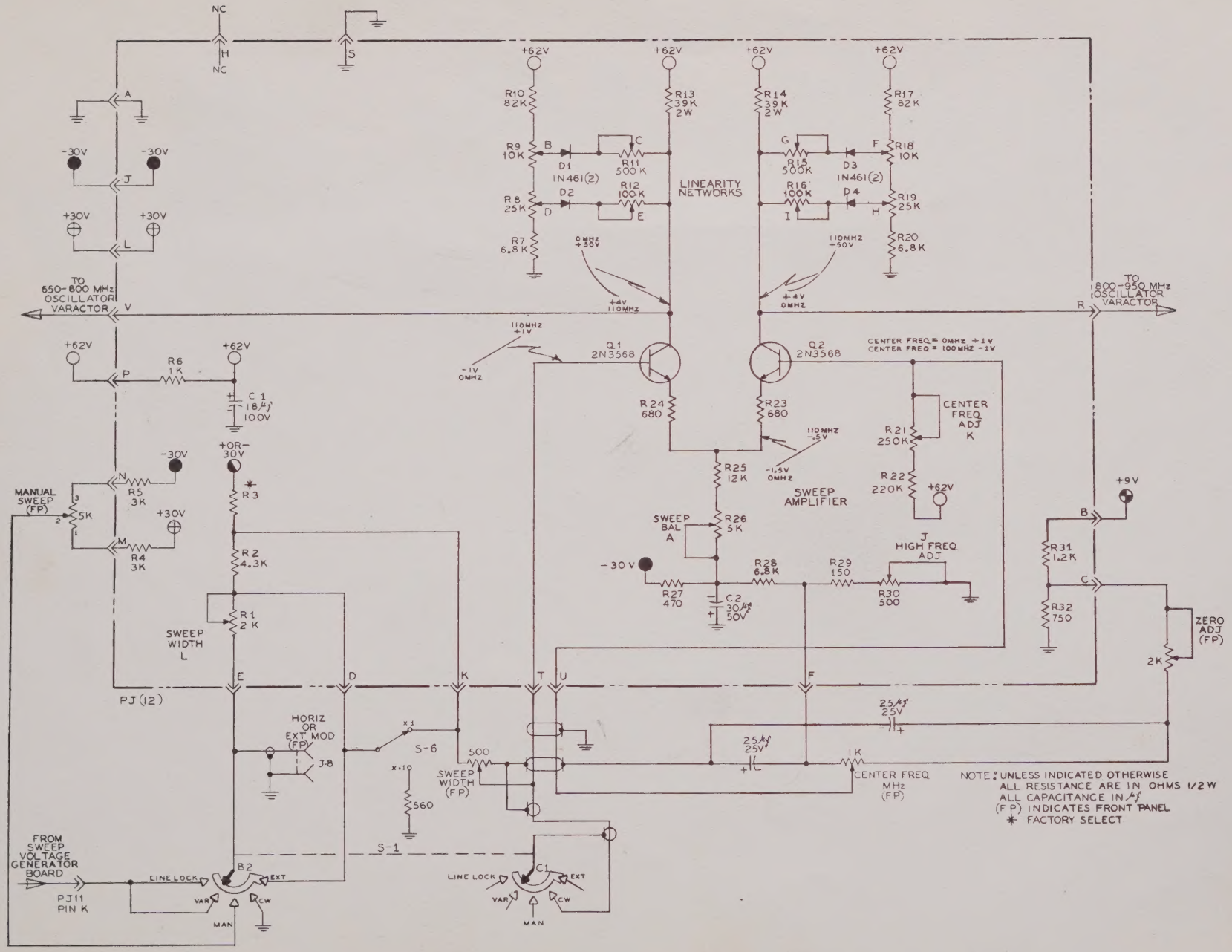


NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/4W
ALL CAPACITANCES ARE IN μf
* FACTORY SELECT

▲ INDICATES WHEN 75 Ω SYSTEM IS REQ:
RESISTORS (R79 = 74 Ω 1%) & (R80 = 79.2 Ω 1%)
ATTENUATOR BECOMES 75 Ω (DWG NOC9920)
MARKED CABLES BECOME 75 Ω

(FP) INDICATES FRONT PANEL

DWG. NO. D9739C MULTI-SWEEP 159C



NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCE ARE IN OHMS 1/2 W
ALL CAPACITANCE IN µf
(FP) INDICATES FRONT PANEL
* FACTORY SELECT

DWG. NO. C9688A P/C/B # 4 [SWP AMP & LINEARITY]